HATCHERY AND GENETIC MANAGEMENT PLAN (HGMP)

DRAFT

Hatchery Program	Friends of the Cowlitz (FOC) Cowlitz River Summer Steelhead (Wallace and Toledo Sand and Gravel Pond Net Pens)
Species or Hatchery Stock	Steelhead (*Oncorhynchus mykiss*)/Summer Run/Cowlitz Trout Hatchery
Agency/Operator	Washington Department of Fish and Wildlife
Watershed and Region	Cowlitz/Lower Columbia
Date Submitted	
Date Last Updated	April 19, 2005

Section 1: General Program Description

1.1 Name of hatchery or program.

Cowlitz River Summer Steelhead

1.2 Species and population (or stock) under propagation, and ESA status.

Summer Steelhead (*Oncorhynchus mykiss)*

ESA Status: Not listed and not a candidate for listing

1.3 Responsible organization and individuals.

Name (and title):	Mark Johnson
	Cowlitz Complex Manager
Agency or Tribe:	Washington Department of Fish & Wildlife
Address:	1182 Spencer Road, Winlock, WA 98596
Telephone:	(360) 864-6135
Fax:	(360) 864-6122
Email:	johnsmjj@dfw.wa.gov

Other agencies, Tribes, co-operators, or organizations involved, including contractors, and extent of involvement in the program.

Co-operators	Role
Tacoma Public Utilities	Funding Source and Facility Maintenance
Friends of the Cowlitz	Coop Group that operates the Wallace Pond Net Pen and Toledo Sand and Gravel Net Pens.

1.4 Funding source, staffing level, and annual hatchery program operational costs.

Funding Sources
Tacoma Public Utilities – Total costs at the Cowlitz Salmon Hatchery cannot be broken down specifically for this portion of spring Chinook production.
Friends of the Cowlitz (FOC) – Non-profit organization provides in-kind services.

1.5 Location(s) of hatchery and associated facilities.

Broodstock source	Cowlitz Hatchery Spring Chinook Stock
Broodstock collection location (stream, RKm, subbasin)	Cowlitz Salmon Hatchery/Cowlitz River/RKm 78.8/Cowlitz
Adult holding location (stream, RKm, subbasin)	Cowlitz Salmon Hatchery/Cowlitz River/RKm 78.8/Cowlitz
Spawning location (stream, RKm, subbasin)	Cowlitz Salmon Hatchery/Cowlitz River/RKm 78.8/Cowlitz
Incubation location (facility name, stream, RKm, subbasin)	Cowlitz Salmon Hatchery/Cowlitz River/RKm 78.8/Cowlitz
Rearing location (facility name, stream, RKm, subbasin)	Cowlitz Salmon Hatchery/Cowlitz River/RKm 78.8/Cowlitz Wallace Pond Net Pens and Toledo Sand and Gravel Pond Net Pens /Cowlitz River/RKm 41.1 and RKm 44.5 /Cowlitz

1.6 Type of program.

Isolated Harvest program

1.7 Purpose (Goal) of program.

The goal is to provide hatchery produced steelhead for recreational fishing in the Cowlitz River.

1.8 Justification for the program.

As a 501(c)3 non-profit organization that began on 1988, Friends of the Cowlitz (FOC) is a citizen organization dedicated to work to restore the runs of anadromous fish (salmon, steelhead and cutthroat trout) in the Cowlitz River and it's tributaries. Landowners, sports fisherman and other interested parties have worked on the fish and wildlife projects for benefit in the Cowlitz River and several major tributaries. FOC is also involved in net pen rearing projects in the lower Cowlitz River with summer steelhead and spring Chinook and as part of the resident trout mitigation in Lake Mayfield. This has been possible because of FOC being able to work successfully with the Washington Department of Fish and Wildlife, Lewis County PUD and BPA. FOC has taken a proactive role in Tacoma Power's relicensing of Mayfield and Mossyrock Dams and participated in the initial Conservation Caucus during these proceedings. The Conservation Caucus was a strong advocate for volitional passage, habitat improvements and improved hatchery practices.

Both, current and future lower and upper river production are described by the Fisheries and Hatchery Management Plan (FHMP) submitted by Tacoma Power for the Cowlitz River Hydroelectric Project (FERC No. 2016). As part of the main hatchery production of fish transferred from Cowlitz Trout Hatchery, the program will continue to provide fish for harvest while minimizing adverse effects on ESA-listed fish and be consistent with the Cowlitz River Fisheries and Hatchery Management Plan (FHMP). Hatchery production for all species through out the 35 year re-licensing term in the remodeled facility will be established after rebuild (>2008) and negotiations with NOAA, WDFW and Tacoma Power (Cowlitz Hydroelectric Project FERC NO. 2016). Current production is a maximum of 550,000 smolts of which up to 100,000 if available are transferred to FOC net pens in late winter - early spring. After rebuild

(> 2008), hatchery production of summer steelhead has been proposed for reduction to 450,000 smolts. This action is designed to reduce predation impacts on listed lower river Chinook or other listed fish in the lower river and could likely reduce the number of summer steelhead adults straying into late winter steelhead spawning areas in the lower river. Both concerns while valid have not been evaluated and based solely on those concerns, future reductions would reduce the significant sport catch by approximately 18% and the subsequent economic benefits derived from summer steelhead program. As little or no wild summer steelhead stock exists, genetic introgression concerns would be with the late winter stock. The spawn timing of this hatchery stock though has been advanced over 3 months since it was first developed in the 1950s which decreases the potential for mixing between summer steelhead and late winter steelhead on the spawning grounds. Given the timing of the summer hatchery component and the late spawn time of existing late winter steelhead stocks in the Lower Columbia ESU, genetic introgression is possibly minimal (see also genetic introgression section 2.2.3).

The FOC summer steelhead releases from the lower provide fish for harvest and is designed to spread out the harvest opportunities in lower Cowlitz River. The river adjacent to Wallace Pond and Toledo Sand and Gravel Pond # 5 is popular drift with fishing guides as fish may imprint to the release site for a time. A WDFW Cooperative Fish and Wildlife Project Memorandum of Understanding Fish Production Agreement is used for monitoring the FOC cooperative programs (see also section 3.2). Summer steelhead releases to the lower river are yearling type smolts at 5.0 –5.5 ffp. The size, time of release based on past history indicates that as smolts, fish released can migrate quickly soon after releases.

In order to maximize harvest and identify hatchery steelhead all FOC net pen summer steelhead are 100% adipose clipped. WDFW provides harvest opportunity on the Cowlitz programs through the Lower Columbia Region Fish Management and Evaluation Plan (FMEP) approved by NOAA on December 31, 2003. The primary focus of anadromous salmonid fisheries in the LCR is to target harvest of known hatchery origin steelhead, spring chinook, coho salmon, sea-run cutthroat, and fall chinook. The primary focus for resident game and non-game fish in the LCR tributaries is to 1) provide recreational opportunities, 2) minimize impacts to juvenile anadromous fish through time and area closures, and 3) minimize impacts to listed species.

In order to minimize impact on listed fish by the Cowlitz River summer steelhead program including the FOC programs, the following Risk Aversion are included in this HGMP:

Table 1. Summary of risk aversion measures for the Cowlitz River summer steelhead program.

Potential Hazard	HGMP Reference	Risk Aversion Measures
Water Withdrawal	4.2	Not applicable to net pens situated in a gravel pit impoundments not accessible to the Cowlitz River.
Intake Screening	4.2	Not applicable to net pens situated in a gravel pit impoundments not accessible to the Cowlitz River.
Effluent Discharge	4.2	The Wallace Pond and Toledo Sand and Gravel Net Pen program meets the guidelines not requiring a NPDES permit as on-site production or feed totals are within limits: • "Upland Fin-Fish Hatching and Rearing" National Pollution Discharge Elimination System (NPDES) general permit (>20,000 lbs total on site production and > 5,000 lbs of fish feed per month).
Broodstock Collection & Adult Passage	7.9	Not applicable to this HGMP. See Cowlitz Salmon Hatchery Spring Chinook HGMP.
Disease Transmission	7.9, 10.11	*Fish Health Policy in the Columbia Basin*. Details hatchery practices and operations designed to stop the introduction and/or spread of any diseases within the Columbia Basin. Also, *Policies and Procedures for Columbia Basin Anadromous Salmonid Hatcheries* (Genetic Policy Chapter 5, IHOT 1995).
Competition & Predation	2.2.3, 10.11	Fish are released as smolted yearlings that emigrate from the basin and Columbia river within the year of release. The release location is low in the river and below several miles of potential lower river habitat.

1.9 List of program "Performance Standards".

This is a final acclimation, imprinting and release site and is a transfer of subyearling fish from the main spring Chinook program at Cowlitz Salmon Hatchery. See Cowlitz Salmon Hatchery Spring Chinook HGMP for additional performance standards, indicators and risks associated with the program.

1.10 List of program "Performance Indicators", designated by "benefits" and "risks".

Benefits		
Performance Standard	**Performance Indicator**	**Monitoring & Evaluation**
Release up to 100,000 steelhead in smolt condition at the Lower Cowlitz River sites.	Fish are released at a time and size (5.0 –5.5 ffp) per statewide rearing guidelines and contribute to hatchery returns similar to rates as other hatchery releases.	Fish releases are tracked and monitored.
Benefits include partnerships and education with local government and local citizens	Friends of the Cowlitz coordinates ongoing and future cooperative projects	Volunteer involvement is tracked yearly and total hours committed are recorded.
Rearing programs operate per Cooperative Fish and Wildlife Project Memorandum of Understanding Fish Production Agreement	Cooperator reviews and submits MOU to WDFW for each year involved in the project.	WDFW compiles MOU and manages volunteer and partnership program reporting procedures
Individual rearing program sites are highly successful at acclimating and releasing fish from the Lower River site.	Program achieves a 90% survival from transfer to release.	Cooperator submits yearly WDFW Volunteer Fish production Project Release and Planting Record Form that includes details on success of program. WDFW reviews and recommends changes if needed.
Program releases fish at a time, size and condition that minimizes impacts and/or interactions to ESA listed fish. See also Risks below.	Program production and numbers of fish reared and released are consistent with the WDFW FBD.	Cooperator submits yearly WDFW Volunteer Fish production Project Release and Planting Record Form that includes details on fish released, date of releases and location of projects.

Risks		
Performance Standard	**Performance Indicator**	**Monitoring & Evaluation**
Program releases fish at a time, size and condition that minimizes impacts and/or interactions to ESA listed fish. See also Risks below.	Program production and numbers of fish reared and released are consistent with the WDFW FBD.	Cooperator submits yearly WDFW Volunteer Fish production Project Release and Planting Record Form that includes details on fish released, date of releases and location of projects.
Net Pen rearing units operate in compliance with all applicable fish health protocols.	Fish health documented. Goal is to prevent the introduction, amplification or spread of fish pathogens that might negatively affect the health of both hatchery and naturally reproducing stock.	FOC Project lead coordinates and communicate regularly with Region 5 staff. Fish are disposed of properly at a landfill.
Ensure net pen rearing operations comply with state and federal water quality and quantity standards through proper environmental monitoring	MOU Section 4. The Cooperator shall also be responsible for obtaining and complying with any and all necessary permits to conduct the project(s) described in the attached Exhibit(s), which may include but are not limited to: Hydraulic Project Approvals (HPA), State Environmental Protection Act checklist (SEPA), National Pollution Discharge Elimination System (NPDES), Water Rights, local construction, grading, or filling permits, etc, with the exception of federal ESA compliance, which can only be deferred upon WDFW or the Treaty Tribes of Washington. MOU Section 4. The Cooperator is responsible for obtaining and complying with any and all necessary permits to conduct the project(s) described in the attached Exhibit(s), which may include but are not limited to: Hydraulic Project Approvals (HPA), State Environmental Protection Act checklist (SEPA), National Pollution Discharge Elimination System (NPDES), Water Rights, local construction, grading, or filling permits, etc, with the exception of federal ESA compliance, which can only be deferred upon WDFW or the Treaty Tribes of Washington.	The Cooperator complies with all permits required and submits MOU to WDFW for each year involved in the project before project is approved.
Net pen complex placement will not affect spawning behavior of natural populations or pose a substantial risk to listed juveniles.	WDFW staff provides technical site evaluation and operational support to minimize impacts and maximize the success of the program.	The Cooperator submits yearly WDFW Volunteer Fish production Project Release and Planting Record Form that includes details success or operational concerns.

1.11.1 Proposed annual broodstock collection level (maximum number of adult fish).

Up to 205 broodstock females are needed for the egg take goal (860,000 FBD 2004). Fecundity is approximately 4,200 eggs. This is approximately 20% of that portion.

1.11.2 Proposed annual fish release levels (maximum number) by life stage and location.

Age Class	Max. No.	Size (ffp)	Release Date	Location			
				Stream	Release Point (RKm)	Major Water-shed	Eco-province
Yearling	50,000	5.0-5.5	April-May	Wallace Pond	44.1	Cowlitz	Lower Columbia
Yearling	50,000	5.0-5.5	April-May	Toledo Sand and Gravel Pond	44.5	Cowlitz	Lower Columbia

1.12 Current program performance, including estimated smolt-to-adult survival rates, adult production levels, and escapement levels. Indicate the source of these data.

FOC steelhead releases are part of the main Cowlitz Summer Steelhead program from the trout hatchery. In the previous Settlement Agreement (SA), production goals for steelhead were mitigated for a total adult return level including summer and winter steelhead and sea-run cutthroat. This was part of the WDFW/TPU mitigation agreement level for a total adult return level of 38,600 adults (Tipping and Harmon Annual Reports 2002). Adult steelhead success is measured by punchcard harvest, representing 70% of the total returns. The new SA eliminated the adult return level mitigation number (FHMP 2004).

Summer steelhead have been planted into the Cowlitz River since 1968 using Skamania stock with the goal of providing a sport fishery and enough escapement to the hatchery to maintain the program. Brood stock for the 1972 and subsequent releases were collected on the Cowlitz River. Return to the hatchery, harvest numbers and % of summer, and winter steelhead plus sea run cutthroat had been used to compare the success of the previous mitigation program. Harvest has increased since 1999 in part due to larger plants and better ocean survival which has led to significant program success at the 500,000 – 600,000 plant level **(Table 2).**

Table 2.

Release Year	Planted	Harvest[a]	Sport Harvest %	Hatchery Escapement[b]
1980	90,144	2,926	3.25	-
1981	125,452	712	0.57	-
1982	31,131	1,237	3.97	-
1983	56,922	1,607	2.82	-
1984	122,983	5,946	4.83	-
1985	144,116	4,881	3.39	-
1986	113,325	2,450	2.16	-
1987	56,908	1,793	3.15	-
1988	82,153	2,874	3.50	-
1989	222,764	5,166	2.32	-
1990	254,681	5,576	2.19	-
1991	268,954	8,297	3.09	-
1992	451,195	11,983	2.66	-
1993	455,276	7,700	1.69	-
1994	436,580	8,064	1.85	-
1995	323,019	9,148	2.83	4,491
1996	386,576	3,722	0.96	5,940
1997	368,325	3,110	0.84	1,628
1998	453,613	3,116	0.68	3,041
1999	546,100	3,638	0.66	1,373
2000	653,500[c]	8,465	1.30	3,523
2001	649,784[c]	10,477	1.61	3,716
2002	614,227[c]	23,010	3.75	10,681
2003	230,973[c]	-	-	6,379
2004	477,224[c]	-	-	13,163
Average	**304,637**	**5,909**	**2.35**	**5,394**

a) Life history calculated at 5.6% 1-salt, 88.0% 2 –salt, 6.4% 3-salt.
b) After the merger of WDG and WDFW (1994), escapement back to the rack is reported from Cowlitz Salmon and Cowlitz Trout Hatcheries. Fish can be used for broodstock or recycled back to stream.
c) Total releases include up to 90,000 from Net Pen programs at two locations on the lower Cowlitz River run by the Friends of the Cowlitz (FOC).

1.14 Expected duration of program.

Summer steelhead production from Cowlitz Trout Hatchery (CTH) is part of the continued operation of the Cowlitz River Hydroelectric Project, FERC Project No. 2016, operated under the new license with an effective date of July 18, 2003. The license is for a term of 35 years and expires July 18, 2038.

1.15 Watersheds targeted by program.

Cowlitz/Lower Columbia

1.16 Indicate alternative actions considered for attaining program goals, and reasons why those actions are not being proposed.

1.16.1 Brief Overview of Key Issues

The key issues of the summer steelhead program in regards to ESA listed fish are the impacts of hatchery smolts on lower river Chinook, coho and late winter steelhead. For hatchery summer steelhead, predation, disease and competition along with genetic introgression are impacts on the listed fish. Handling of listed fish occurs during adult collection at the Cowlitz Salmon hatchery separator unit with both hatchery and wild fish are collected, sorted, held and distributed to any number of programs scenarios including upper river adult reintroduction (FHMP). The program releases a yearling smolt at a time, size and condition factor per WDFW Steelhead Rearing Guidelines (July 31, 2001). The steelhead guidelines indicate the weight, length frequency and condition factors at release that results in rapid emigration behavior and minimizes residualism. All releases are made below the Cowlitz River barrier dam downstream of the Tilton River/Lake Mayfield system and the Upper Cowlitz system above Lake Scanewa. Significant reintroduction and recovery programs for fall and spring Chinook and coho salmon along with winter steelhead and sea run cutthroat have been ongoing in those areas since 1996. Natural production from upriver areas are collected at the CFFF and released as smolts from the salmon hatchery after acclimating in the stress relief ponds. Smolts of all wild fish range from 101.7 – 199.2 mm fl depending on species (Serl and Morrill 2004). By this time, the upriver production is at a size and condition indicating rapid emigration from the lower river. Two additional summer steelhead release sites of approximately 50k each are made near the town of Toledo 8.0 and 12.0 river miles below the Cowlitz Trout Hatchery. Boat ramps provide access at the Cowlitz Trout Hatchery and the lower river release sites near where I-5 crosses the Cowlitz River. The purpose of the release of Cowlitz stock (a derivative of Skamania stock) summer steelhead into the Cowlitz River is to continue a summer steelhead sport fishery while eliminating a directed harvest on wild summer steelhead. Adults are trapped at Cowlitz Salmon Hatchery (CSH) and are spawned and incubated at Cowlitz Trout Hatchery (CTH). Rearing takes place at CTH Hatchery and in net pens at Toledo Sand and Gravel. Returning hatchery steelhead that are trapped at the Barrier Dam are marked and returned to the river just above the confluence with Blue Creek (RKm 66.1) for additional harvest opportunity or broodstock collection.

1.16.2 Potential Alternatives to the Current Program

Alternative 1: Eliminate the program. This action would eliminate potential interaction with the natural population and eliminate impacts on other ESA listed species.

Pros: Eliminating the summer steelhead program would eliminate any potential risks to listed species in the system due to indirect impacts including predation, competition, disease and genetic introgression. It is unknown if avian or mammal predation that occurs on hatchery smolts would then be shifted 100% to listed stocks in this scenario.

Cons: This alternative is not considered acceptable; currently this program supports a very popular sport fishery and significant economic benefits statewide and the Lower Columbia River region. If the program was eliminated, the goals of the Cowlitz Basin Fish Management Plan (WDFW), Cowlitz Fish Hatchery and Management Plan (FHMP) and Settlement Agreement (FERC 2016) would not be met. Thousands of hours of bank fishing would be eliminated from May – October of the year as well as significant personal boating and guide trips through out the same period. Pressure would be shifted to other rivers less capable of sustaining the fishing effort.

Alternative 2: Reduce the program per FHMP proposals A reduction of 18% of the summer steelhead production has been proposed after rebuild (>2008).

Pros: In the new SA, the Cowlitz Complex facilities will be remodeled by 2008 and the production for all indigenous and non-endemic stock programs are being proposed for reductions (FHMP). In large part, reductions for non-endemic summer and early stock winter steelhead are proposed in order to reduce the impacts to listed fish. Actual impacts to listed fish from non-endemic stocks have not been evaluated in the Cowlitz system. Reducing production might reduce densities in rearing units and provide space for future hatchery programs.

Cons: Reductions are based on reducing indirect potential impacts on listed fish even though specific evaluations are not conducted to base those decisions on scientific data. Future reductions of integrated programs are in large part dependent on the upper basin productivity and future habitat improvements including fish passage upstream and downstream in the Project (FERC 2016). As hatchery production is required to provide adult broodstock for spawning and nutrient enhancement needed for ecosystem productivity, a reduction in the current program could reduce hatchery production below critical hatchery threshold levels that would result in long term harm to the system.

Alternative 3: Retain current production

Pros: Continue to manage the Lower Cowlitz River system as one of the largest summer steelhead producers in the state. The large size of the Cowlitz River is conducive to large boats for guide trips and significant access is still available to bank anglers at release points and other locations. Minimum summer and fall flows are managed by Tacoma Power to provide sufficient flows throughout the summer and early fall when other rivers can suffer low flow periods which eliminates most steelhead angling. Depending on the size of the spring chinook run, summer steelhead provides the bulk of harvest and recreational opportunity from May until early fall when fall Chinook or coho runs materialize.

Cons: Potential risks to listed species in the system due to indirect impacts including predation, competition, disease and genetic introgression would remain at current levels. Depending on hatchery remodel, pond design configurations for increasing smolt quality could be offset by current levels of production or any increases. Funding for production would take away from other priorities in the area.

1.16.3 Potential Reforms and Investments

Reform/Investment 1: There would be a negative impact region wide to elimination of the program. Angling restrictions would likely become more restrictive to protect any wild summer run fish in the Cowlitz system or in other neighboring systems due to the increase in pressure. Evaluating the impact would require funding.

Reform/Investment 2: Reducing the program per FHMP proposals would size the program to the new remodel design in order to benefit fish culture rearing parameters to produce high quality smolts.

Reform/Investment 3: Funding for maintaining the current production or increases would be needed. Potential lower river release and retention sites would need to be developed to concentrate releases below significant stretches of the lower river productivity of listed fish.

Section 2: Program Effects on ESA-Listed Salmonid Populations

2.1 List all ESA permits or authorizations in hand for the hatchery program.

None, although NOAA Fisheries has consulted on the operations of all the fish production activities at these facilities as part of a Columbia River basin wide hatchery biological opinion in 1999 for listings prior to 1998. On March 23, 2004, NOAA Fisheries (Consultation No. 2001/02045) issued a Biological Opinion for the Cowlitz River Hydroelectric Project (FERC No. 2016).

2.2.1 Descriptions, status and projected take actions and levels for ESA-listed natural populations in the target area.

The following ESA listed natural salmonid populations occur in the subbasin where the program fish are released:

ESA listed stock	Viability	Habitat
Spring Chinook	M	L
Cowlitz Fall Chinook	L	L
Coweeman Fall Chinook-Natural	H	M
Toutle Fall Chinook	M	L
Late Winter Steelhead	H	L
Coho- (Proposed)	Na	Na
Chum	Na	Na
H, M and L refer to high, medium and low ratings, low implying critical and high healthy.		

2.2.1) Description of ESA-listed salmonid population(s) affected by the program.

Identify the ESA-listed population(s) that will be directly affected by the program.

None.

Identify the ESA-listed population(s) that may be incidentally affected by the program.

Lower Columbia River fall chinook salmon (*Oncorhynchus tshawytscha*) are listed as "threatened" under the ESA on May 24, 1999.
Lower Columbia River spring chinook salmon (*Oncorhynchus tshawytscha)* listed as "threatened" under the ESA on May 24, 1999.
Lower Columbia River Steelhead (*Oncorhynchus mykiss)* listed as "threatened" under the ESA on March 19, 1998.
Lower Columbia River Coho salmon (*Oncorhynchus kisutch)* within the Lower Columbia River/Southwest Washington Evolutionary Significant Unit (ESU) were proposed as threatened under the federal Endangered Species Act in 2004 (NOAA 69 FR 33101; 6/14/2004).
Columbia River Chum salmon (*Oncorhynchus keta)* listed as "threatened" under the ESA on March 25, 1999.

2.2.2 Status of ESA-listed salmonid population(s) affected by the program.

Describe the status of the listed natural population (s) relative to "critical" and "viable" population thresholds.

Critical habitat designations for LCR chinook salmon, LCR steelhead, and CR chum salmon are no longer in effect (68 Federal Register (FR) 55900 (Sept 29, 2002). Recovery planning interim viability criteria for the Willamette/Lower Columbia domain were developed by the WLCTRT (McElhany et al. 2003). Current and future recovery goals and population targets have been established for Chinook, coho, chum and steelhead populations in the LCR ESU by the Lower Columbia Fish Recovery Board (LCFRB Basin Plans 2004).

Lower Columbia River spring chinook salmon (*Oncorhynchus tshawytscha*): Cowlitz Hatchery Spring Chinook are integrated with the Upper Historic population under NOAA's proposed listing determination (69 FR 33102; 6/14/2004). The current spring Chinook hatchery stock is listed as a core genetic legacy population in the Cowlitz system **(**Myers et al. 2002), and core/legacy status (McElhany et al. 2003). Natural escapement levels in the lower river below the barrier dam (which include hatchery-origin fish) are typically only 200 to 400 fish (SaSI 2002), although escapement in 2003 and 2004 have increased significantly **(Table 3).** Estimates of adults above Mayfield Dam in the 1960's indicated approximately 9,900 spring Chinook (Serl and Morrill 2004). Currently, significant numbers of adults have been transported the past few years approaching these numbers. Current carrying capacity for spring Chinook smolts in the upper Cowlitz basin is 311,000 smolts (Serl and Morrill 2004). Current productivity in the upper system is approximately 225,000 smolts although less than 40,000 - 45,000 smolts (19%) can be collected at the CFFF (Serl and Morrill 2004). Spring Chinook short and long term objectives for the programs are covered in Section 5.1 (FHMP). Tacoma Power continues to truck adults above the Cowlitz Falls Dam as part of the anadromous reintroduction program.

Table 3. Spring Chinook Abundance Estimates in the Lower Cowlitz River

Year	Lower Cowlitz River	Year	Lower Cowlitz River
1990	320	1998	356
1991	284	1999	285
1992	279	2000	266
1993	236	2001	347
1994	167	2002	419
1995	347	2003	1,937
1996	36	2004	1,793
1997	455	2005	

Source – Lower Columbia Region FMEP 2003 and WDFW Spawning Surveys (2004).

Lower Columbia River fall chinook salmon *(Oncorhynchus tshawytsch*a): In 1951, the fall chinook escapement to the Cowlitz River and tributaries was estimated at 31,000, with the following distributions: 10,900 to the mainstem Cowlitz and its minor tributaries, 8,100 to the Cispus, 500 to the Tilton, 6,500 to the Toutle, and 5,000 to the Coweeman (WDF 1951). Forty-six percent of the fall chinook run in the Cowlitz River was estimated to have come from above Mayfield Dam in 1950 to 1961, and 28 percent of the spawning grounds were inundated by Mayfield and Mossyrock reservoirs (Easterbrooks 1980). Age ranges from 2-year-old jacks to 6-year-old adults, with dominant adult age of 3, 4, and 5 (averages are 16.49%, 58.05%, and 19.31%, respectively). Natural spawning abundance is more a reflection of the size of returns to the Cowlitz Salmon Hatchery and stray rates than of natural production. The natural spawning escapement goal is 3,000 adults. Until 2001 the goal had not been met since 1989 (SaSI 2002). In

2002, escapement was 1,427 while 2003 had 10,329 and 4,466 were reported for 2004 (**Table 4**). Most of the spawning takes place between the Kelso Bridge and the Cowlitz Salmon Hatchery (WDF et. al. 1993). Fall Chinook will not be used in the upper Cowlitz while the spring Chinook evaluation is ongoing but adults are taken to the Tilton River.

Coweeman River: Historically, Coweeman River fall chinook spawned from Mulholland Creek (RM 18.4) downstream approximately 6 miles to the Jeep Club Bridge (WDF et. al. 1993). The estimated annual escapement of fall chinook in 1951 was 5,000, although splash dams probably impacted production (WDW 1990). The Coweeman River has received fall chinook plants from at least 1951 until 1979 (WDW 1990). SaSI (WDF et. al. 1993) listed fall chinook stocks as healthy in 1993; status today is depressed (SaSI 2002).

Toutle River Fall Chinook. Natural spawners of both hatchery and natural origin in the Toutle subbasin averaged 6,573 fish from 1964 through 1979 with the following distribution: 4.8 percent from the mainstem, 3.8 percent South Fork Toutle, 49.4 percent North Fork Toutle, and 42 percent Green River (Kreitman 1981 as cited in WDW 1990). Natural spawners (hatchery and natural origin) from 1964 through 1979 averaged 42 percent (equal to 4,517 fish) of the Toutle subbasin spawners, which were estimated at 10,756 fish (Kreitman 1981 as cited in WDW 1990). From 1990–2001, escapement in the South Fork Toutle system averaged 57 fish although significant increases in fall Chinook escapement for 2002 and 2003 reflect the Lower Columbia River trend for those past 2 years.

Table 4. Fall chinook salmon abundance estimates in the Cowlitz System.

Year	Coweeman River	Cowlitz River	Green River	SF Toutle River
1990	241	2,698	123	0
1991	174	2,567	123	33
1992	424	2,489	150	0
1993	327	2,218	281	3
1994	525	2,512	516	0
1995	774	2,231	375	30
1996	2,148	1,602	667	351
1997	1,328	2,710	560	0
1998	144	2,108	1,287	66
1999	93	997	678	42
2000	126	2,700	852	27
2001	646	5,013	4,951	132
2002	891	14,427	7,452	444
2003	1,082	10,329	13,806	137
2004	1,550	4,466	4,108	603

Source – LCR FMEP (2003) up to 2001. 2002 – 2004 data from WDFW database.

Lower Columbia River Steelhead *(Oncorhynchus mykiss*): In Washington, the LCR steelhead ESU includes winter and summer steelhead in tributaries to the Columbia River between the Cowlitz River and Wind River. The Cowlitz system had six historical populations including three core (Cispus, Upper Cowlitz, and N.F. Toutle) populations. All are winter steelhead stocks and the Cispus winter run population hatchery stock is listed as a core genetic legacy population (Myers et al. 2002), and core/legacy status (McElhany et al. 2003). Late winter steelhead have been reintroduced into the upper system (**Table 5).**

Table 5. Late Winter Steelhead Adults transported to the Upper Cowlitz River Basin, 1996 - present.

Year	UM – Unmarked STHD			RV – Right Ventral Clip			AD – Adipose Clip			Totals
	UM-Female	UM-Male	UM-Jack	RV - Female	RV - Male	RV – Jack	AD-Male	AD – Female	AD - Jack	
1996-7	22	12	0	5	14	0	0	1	0	54
1997-8	6	5	0	5	1	0	26	23	0	66
1998-9	15	24	13	10	29	3	6	49	8	157
1999-2000	108	107	0	28	73	0	19	77	0	412
2000-01	133	125	37	71	122	20	70	124	27	729
2001-02	346	419	1	174	492	1	453	898	3	2,787
2002-03	316	205	2	335	241	0	933	497	3	2,532
2003-4	146	146	4	100	167	0	214	619	1	1,397
2004-5										
Totals										

Source - *DRAFT* 2004 ANNUAL REPORT FOR THE COWLITZ FALLS PROJECT `

Lower Columbia River Coho: Cowlitz Hatchery coho stock are integrated with the Upper and Lower Cowlitz historic population under NOAA's proposed listing determination (69 FR 33102; 6/14/2004). Presently, most Cowlitz River coho are of hatchery origin. Mayfield Dam has blocked tributaries above river kilometer (rkm) 83.2 since 1968 but natural production still occurs in several small tributaries of the lower Cowlitz including Olequa, Lacamas, Ostrander, Blue, Otter, Brights, Mill, Arkansas, Foster, and Hill creeks. Adults are also released each year to spawn in the Tilton and upper Cowlitz and Cispus rivers. The Washington Department of Fisheries estimated coho escapement at about 32,500 fish in 1951. Coho counts past Mayfield from 1961-66 averaged 24,579. Hatchery-produced returns averaged 24,997 adults and 9,723 jacks in 1980-94 with a peak of 54,685 adults in 1986 and 19,178 jacks in 1987. The Northwest Power Planning Council's model estimated smolt production capacity of 123,123 for the lower Cowlitz River, 131,318 for Tilton River and Winston Creek, and 155,018 for above Cowlitz Falls. Presently, most Cowlitz River coho are of hatchery origin although significant numbers of NOS have been identified and taken to the upper Cowlitz **(Table 6)** and the Tilton River system since 1996 **(Table 7).**

Table 6. Hatchery Coho adults transported to the Upper Cowlitz River Basin, 1996 - present.

Year	UM – Unmarked Coho			AD – Adipose Clipped Coho			Totals
	UM-Female	UM-Male	UM-Jack	AD - Female	AD - Male	AD – Jack	
1996-7	0	0	0	932	594	629	2,155
1997-8	0	0	0	2,774	1,262	464	4,500
1998-9	0	0	0	4,128	4,140	3,154	11,422
1999-2000	2,398	2,383	120	10,594	11,635	7,197	34,327
2000-01	514	778	284	14,653	16,674	9,566	42,469
2001-02	1,150	1,644	96	15,504	21,564	1,497	41,455
2002-03	3,661	4,688	416	23,698	30,490	6,300	69,253
2003-04	3,477	4,511	484	9,526	11,169	6,143	35,310
2004-05							
Totals	11,200	14,004	1,400	81,809	97,528	34,891	240,891

Source - *DRAFT* 2004 ANNUAL REPORT FOR THE COWLITZ FALLS PROJECT

Table 7. Annual numbers of adult fall Chinook (FCK), coho salmon, winter steelhead (WSH), late Winter Steelhead (LWS), and sea-run cutthroat trout adults transported into the Tilton River system from Cowlitz Salmon Hatchery (CSH) by origin, species, and sex.

Year	Hatchery						Wild				
	Species	Females	Males	Jacks	Non sexed	**Total Hatchery**	Females	Males	Jacks	Non sexed	**Total Wild**
1997	FCK	3	24	84		**111**					**0***
	Coho	867	2,766	2,056		**5,689**					
	WSH	293	289		286	**868**	8	11			**19**
	SRCT									79	**79**
1998	FCK	2	98	141		**241**					**0***
	Coho	903	1,106	1944		**3,953**	535	647	460		**1,642**
	WSH	92	158	83		**333**					
1999	FCK		1	72		**73**					
	Coho	2,469	3,058	2,471		**7,998**	573	673	29		**1,275**
	WSH				339	**339**		104			**104**
	SRCT							62			**62**
2000	FCK		1	636		**637**					**0***
	Coho	4,933	6,138	4,006		**15,077**	159	252	85		**496**
	WSH	324	323		7	**654**	72	47			**119**
	LWSH						2	6			**8**
	SRCT										
2001	FCK	397	1,079	1,065		**2,541**					**0***
	Coho	12,569	14,770	1,808		**29,147**	660	1063	156		**1,879**
	WSH	214	320	8		**542**	88	84			**172**
	LWSH						1				**1**
	SRCT									92	**92**
2002	FCK	167	405	16		**588**					**0***
	Coho*	6,165	7,989	1,673		**15,827**	525	661	69		**1,255**
	WSH	477	601	3	451	**1,532**	152	153	1	300	**606**
	LWSH									12	**12**
	SRCT									7	**7**
2003**	FCK	1,968	2,317			**4,285**					**0***
	Coho	3,465	3,341			**6,806**					**617**
	WSH					**0**					**84**
	LWSH					**377**					**74**
	SRCT					**0**					**617**
2004**	FCK					**1,550**					**0***
	Coho					**12,030**					**381**
	WSH					**0**					**319**
	LWSH					**503**					**26**
	SRCT										**69**

Surce – Cowlitz Salmon Hatchery annual reports and D. Harmon (2002-2003).
0* Fall Chinook wild/hatchery cannot be determined without mass mark to this point.
** Data for 2003 and 2004 male/female breakdowns not yet available.

Columbia River Chum salmon (*Oncorhynchus keta)* listed as "threatened" under the ESA on March 25, 1999. Chum were reported to historically utilize the lower Cowlitz River and tributaries downstream of the Mayfield Dam site. Typically less than 20 adults are collected annually at the Cowlitz Salmon Hatchery with adults hauled downstream to suitable spawning habitat areas. In the 1990s November commercial fisheries were curtailed and retention of chum was prohibited in Columbia River sport fisheries.

2.2.3 Describe hatchery activities, including associated monitoring and evaluation and research programs, that may lead to the take of listed fish in the target area, and provide estimated annual levels of take.

Describe hatchery activities: The following hatchery activities are identified in the ESA Section 7 Consultation "Biological Opinion on Artificial Propagation in the Columbia River Basin" (March 29, 1999). In other HGMPs provided to NOAA (Puget Sound, Upper Columbia), indirect takes from hatchery releases such as predation and competition is highly uncertain and dependant on a multitude of factors (i.e. data for population parameters - abundance, productivity and intra species competition) and although HGMPs discuss our current understanding of these effects, it is not feasible to determine indirect take (genetic introgression, density effects, disease, competition, predation) due to these activities. As broodstock are not collected by this acclimation and release program, there is no take of listed fish. The impacts below are taken from the Cowlitz River summer steelhead program.

Broodstock Program:

Broodstock Collection: Summer steelhead can be trapped from late summer through early winter at Cowlitz Salmon Hatchery and to a lesser extent at Cowlitz Trout Hatchery. Only identified hatchery fish are retained for spawning.

Genetic introgression: Most adults are collected from late summer through early winter. This time frame reduces the chance of mixing summer steelhead with late arriving (June) "late" winter steelhead or early arriving (October) winter steelhead and crew can distinguish stocks by coloration. Individuals spawned are randomly selected from those females ripening after December 1. Females ripening prior to December 1 are rejected for spawning although in some years, maturation is early as in 2003. Spawning will occur from December (50%) through January (50%) and will be completed by January 31 (it has proven difficult to get 50% of the eggs taken during January as most females ripen in December). Spawning ground data indicate a few wild steelhead redds begin to appear in early to late March, abundance peaks in late April to early May, and last redds are constructed in late May to early June. Spawning time is dependent on water temperatures resulting in the range. Spawning success of hatchery fish appears low as few naturally produced summer steelhead are observed.

Rearing Program:

Operation of Hatchery Facilities: See HGMP section 4.2 for water withdrawal, intake screening compliance and hatchery effluent discharges.

Disease: Outbreaks in the hatchery may cause significant adult, egg, or juvenile mortality. Policies and Procedures for Columbia Basin Anadromous Salmonid Hatcheries (IHOT 1995) chapter 5 have been instrumental in reducing disease outbreaks. Although Cowlitz Salmon or Cowlitz Trout Hatcheries have been noted as potential sources of fish pathogens including bacterial kidney disease, *Ceratomyxa shasta*, and IHNV, these diseases are also present in the natural spawning populations (Tacoma Power and Utility, 2000).

Release:

Hatchery Production/Density-Dependent Effects: Current production is a maximum of 550,000 smolts. After rebuild (> 2008) hatchery production of summer steelhead has been reduced to 450,000 smolts. This action is designed to reduce possible predation impacts on listed lower river Chinook populations and would likely to reduce the number of summer steelhead adults straying into late winter steelhead spawning areas in the lower river. Both concerns while valid, have not been evaluated to warrant a future reduction based on those concerns at this time. As little or no wild summer steelhead stock exists, genetic introgression on the late winter stock is remote due to the advance timing of the hatchery component (See genetic introgression). Predation is possible based on predator – prey length relationships (See relative body size below), but based in large part the density and characteristics of the stocks concerned.

Competition: Studies and monitoring programs on many systems throughout Washington indicate that salmon and steelhead smolts released from hatchery programs in larger river systems migrate rapidly downstream with migration rates of approximately 20 river miles per day observed by steelhead smolts in the Cowlitz River (Harza 1998). Once in the lower Columbia River mainstem of tidal influence, in a study designed to define the emigrational characteristics of chinook salmon, coho salmon, and steelhead trout in the Columbia River estuary, Dawley et al (1984), found the average migration rates for subyearling chinook, yearling chinook, coho salmon, and steelhead were 22, 18, 17, and 35 RKm daily respectively.

Predation: Hawkins and Tipping (1999) reported that in 1998, nearly half of the hatchery steelhead smolts sampled on the Lewis River, Washington contained Chinook salmon fry and the smolts had consumed a mean of 1.13 fry each. The predation rates cited above were associated with extremes in Chinook salmon fry abundance; low predation rates had low spawner densities and high predation rates had high spawner densities. However, Cannamela (1993) and Jonasson et al. (1995) found low rates of predation on upper Columbia River tributaries, with 0.0% to 0.18% of hatchery steelhead smolts containing juvenile Chinook salmon. Recent research in Puget Sound has correlated low hatchery steelhead predation in systems with low to moderate levels of juvenile Chinook abundance. Of 1,407 steelhead smolts captured in the Deschutes River smolt trap and 90 juveniles captured by angling, none contained any salmonid fry or parts thereof. Similarly, no fall Chinook were noted in the 903 Green River hatchery steelhead examined by gastric lavage. In both watersheds, the majority of the steelhead juveniles were actively feeding based on the presence of insects and other invertebrates in 69% and 78% of the smolt trapped specimens in the Deschutes and Green rivers, respectively, and all of the fish captured by angling in the Deschutes River.

Predation Risk Factors:

Environmental Characteristics: These characteristics can influence the level of predation (see SIWG 1984 for a review) with risk greatest in small systems during periods of low flow and high clarity. The Cowlitz River is a large river system averaging 6,664 and 7,490 cfs during April and May (USGS-Real Time average 1934- present). Below I-5, the Toutle River, a large tributary of the Cowlitz River adds another 2,000 – 2,600 cfs to the system.

Dates of Releases: Steelhead are released mid-April to May 1st. Listed fish can be present in some part of the timing of the steelhead release.

Relative Body Size: Salmonid predators were thought to be able to prey on fish up to approximately 1/3 of their length (USFWS 1994), although coho salmon have been observed to consume juvenile chinook salmon of up to 46% of their total length or larger in aquarium environments (Pearsons et al. 1998). The "33% of body length" criterion for evaluating the potential risk of predation in the natural environment has been used by

NOAA Fisheries and the USFWS in a number of biological assessments and opinions (c.f., USFWS 1994; NMFS 2002). Although predation on larger chinook juveniles may occur under some conditions, WDFW believes that a careful review of the Pearson and Fritts (1999) study supports the continued use of the "33% of body length criterion" until further data for individual rivers can be collected.

Release Location and Release Type: The release from the Cowlitz Salmon Hatchery is directly to the lower river at RKm 78.8. This is below the upper river productivity. It is likely that a significant portion of migration and dispersal of the hatchery program occurs before peak emergence of listed winter steelhead. Although the release is not totally volitional, most fish quickly vacate the pond as soon as screens are removed.

Residualism: To maximize smolting characteristics and minimize residual steelhead, WDFW adheres to a combination of acclimation, volitional release strategies, active pond management, size, and release guidelines (Steelhead Guidelines, July 2001). Condition factors including a lean .90-.99 K factor and co-efficient of variation (CVs) of less than 10% are steelhead rearing guidelines. Active pond management can remove non-growing fish from the population.

Migration Corridor/Ocean: It is unknown to what extent listed fish are available both behaviorally or spatially on the migration corridor. Once reaching the mainstem Columbia River, hatchery smolts appear to travel quickly. In a study designed to define the emigrational characteristics of chinook salmon, coho salmon, and steelhead trout in the Columbia River estuary, Dawley et al (1984), found the average migration rates for subyearling chinook, yearling chinook, and coho salmon and steelhead, were 22, 18, 17, and 35 RKm/d respectively. There appear to be no studies demonstrating that large numbers of Columbia system smolts emigrating to the ocean affect the survival rates of juveniles in the ocean in part because of the dynamics of fish rearing conditions in the ocean. Indirect take in the migration corridor or ocean is unknown.

Monitoring:

Associated monitoring Activities: In the new SA, interaction between hatchery and wild adult salmonids will be managed by monitoring key tributary escapements of coho, steelhead, cutthroat and chum. Interaction between hatchery-released fish and wild fish in the lower Cowlitz will be studied and may result in review of release strategies.

The following monitoring baseline activities are conducted in the Lower Columbia Management Area (LCMA) for adult steelhead and salmon: redd surveys are conducted for winter steelhead in the SF Toutle, Coweeman, EF Lewis, and Washougal rivers. Redd surveys are also conducted in the Cowlitz River for fall and spring chinook. Mark-recapture surveys provide data for summer steelhead populations in the Wind and Kalama rivers. Mark-recapture carcass surveys are conducted to estimate populations of chinook salmon in Grays, Elochoman, Coweeman, SF Toutle, Green, Kalama, NF Lewis, EF Lewis, rivers and Skamokawa, Mill, Abernathy, and Germany creeks and for all chum salmon populations. Snorkel surveys are conducted for summer steelhead in the EF Lewis, Washougal rivers. Trap Counts are conducted on the Cowlitz, NF Toutle, Kalama, and Wind rivers and on Cedar Creek a tributary of the NF Lewis River. Area-Under-the-Curve (AUC) surveys are conducted to collect population data for chum salmon in Grays River and Hardy and Hamilton Creeks. All sampling of carcasses and trapped fish include recovery of coded wide tagged (CWT) fish for hatchery or wild stock evaluation. Downstream migrant trapping occurs on the Cowlitz, Kalama, NF Lewis, and Wind rivers, Cedar Creek, and will expand to other basins as part of a salmonid life cycle monitoring program to estimate freshwater production and wild smolt to adult survival rates. Any take associated with monitoring activities is unknown but all follow scientific protocols designed to minimize impact.

Provide projected annual take levels for listed fish by life stage (juvenile and adult)

quantified (to the extent feasible) by the type of take resulting from the hatchery program (e.g. capture, handling, tagging, injury, or lethal take).
Collection of summer steelhead broodstock is done in conjunction with multiple listed species at the Cowlitz Salmon hatchery seperation facility. Marked fish are removed and taken to Cowlitz Trout Hatchery. No listed fish are taken in this broodstock collection, therefore no take table will be submitted with this HGMP.

In other HGMPs provided to NOAA (Puget Sound, Upper Columbia), indirect takes from hatchery releases such as predation and competition is highly uncertain and dependant on a multitude of factors (i.e. data for population parameters - abundance, productivity and intra species competition) and although HGMPs discuss our current understanding of these effects, it is not feasible to determine indirect take (genetic introgression, density effects, disease, competition, predation) due to these activities.
Indicate contingency plans for addressing situations where take levels within a given year have exceeded, or are projected to exceed, take levels described in this plan for the program.
Any additionally mortality from this operation on a yearly basis would be communicated to Fish program staff for additional guidance. For other listed species, if significant numbers of wild salmonids are observed impacted by this operation, then staff would inform the WDFW District Biologist who along with the Complex Manager would determine an appropriate plan and consult with NOAA if needed.

Residualism: To maximize smolting characteristics and minimize residualism, WDFW adheres to a combination of acclimation, size, and time guidelines. Condition factors, standard deviation and co-efficient of variation (CV) are measured through out the rearing cycle and used for determining release time.

- Feeding rates and regimes through out the rearing cycle are programmed to satiation feeding to minimize out of size fish and programmed for smolt phase as release or plant times approach.
- Based on past history, fish have reached a size and condition that indicates a smolted condition at release.
- Releases occur within known time periods of species emigration from acclimated ponds.

Migration Corridor/Ocean: It is unknown to what extent listed fish are available both behaviorally or spatially on the migration corridor. Once reaching the Columbia River, fish appear to travel quickly. Median Travel Time of subyearling chinook, on the mainstem Columbia River, from McNary to Bonneville Dam was estimated to average 8.0 days (29.2 RKm/d) during the years 1997 to 2003 (Memo- Michele DeHart to Bill Tweit (WDFW), 2003). In a study designed to define the migrational characteristics of chinook salmon, coho salmon, and steelhead trout in the Columbia River estuary, Dawley et al (1984), found the average migration rates for subyearling chinook, yearling chinook, and coho salmon and steelhead, were 22, 18, 17, and 35 RKm/d respectively. There appear to be no studies demonstrating that large numbers of Columbia system smolts emigrating to the ocean affect the survival rates of juveniles in the ocean in part because of the dynamics of fish rearing conditions in the ocean. Indirect take in the migration corridor or ocean is unknown.

Monitoring:

Associated monitoring Activities: Interaction between hatchery and wild adult salmonids will be managed by monitoring key tributary escapements of coho, steelhead, cutthroat and chum. Interaction between hatchery-released fish and wild fish in the lower Cowlitz will be studied and may result in review of release strategies.

The following monitoring baseline activities are conducted in the Lower Columbia Management Area (LCMA) for adult steelhead and salmon: redd surveys are conducted for winter steelhead in the SF Toutle, Coweeman, EF Lewis and Washougal rivers. Redd surveys are also conducted in the Cowlitz River for fall and spring chinook. Mark-recapture surveys provide data for summer steelhead populations in the Wind and Kalama rivers. Mark-recapture carcass surveys are conducted to estimate populations of chinook salmon in Grays, Elochoman, Coweeman, SF Toutle, Green, Kalama, NF Lewis, EF Lewis, rivers and Skamokawa, Mill, Abernathy, and Germany creeks and for all chum salmon populations. Carcass surveys on Cowlitz spring and fall Chinook are conducted annually. Snorkel surveys are conducted for summer steelhead in the EF Lewis, Washougal rivers. Trap Counts are conducted on the Cowlitz, NF Toutle, Kalama, and Wind rivers and on Cedar Creek a tributary of the NF Lewis River. Area-Under-the-Curve (AUC) surveys are conducted to collect population data for chum salmon in Grays River and Hardy and Hamilton Creeks. All sampling of carcasses and trapped fish include recovery of coded wide tagged (CWT) fish for hatchery or wild stock evaluation. Downstream migrant trapping occurs on the Cowlitz, Kalama, NF Lewis, and Wind rivers, Cedar Creek, and will expand to other basins as part of a salmonid life cycle monitoring program to estimate freshwater production and wild smolt to adult survival rates. Any take associated with monitoring activities is unknown but all follow scientific protocols designed to minimize impact. See also HGMP section 11.0 (Monitoring).

Provide projected annual take levels for listed fish by life stage (juvenile and adult) quantified (to the extent feasible) by the type of take resulting from the hatchery program (e.g. capture, handling, tagging, injury, or lethal take).

Refer to the Cowlitz Spring Chinook HGMP for any take numbers.

Indicate contingency plans for addressing situations where take levels within a given year have exceeded, or are projected to exceed, take levels described in this plan for the program.

Any additionally mortality from this operation on a yearly basis would be communicated to Fish program staff for additional guidance. For other listed species, if significant numbers of wild salmonids are observed impacted by this operation, then staff would inform the WDFW District Biologist who along with the Complex Manager would determine an appropriate plan and consult with NOAA if needed.

Section 3: Relationship of Program to Other Management Objectives

3.1 Describe alignment of the hatchery program with any ESU-wide hatchery plan (e.g. *Hood Canal Summer Chum Conservation Initiative*) or other regionally accepted policies (e.g. the *NPPC Annual Production Review* Report and Recommendations - NPPC document 99-15). Explain any proposed deviations from the plan or policies.

The production developed for this program will be integrated with *U.S. v Oregon* and the Columbia River Fish Management Plan (CRFMP) and with hatchery plans documented in WDFW's yearly Future Brood Document (FBD), and Lower Columbia Fisheries Management and Evaluation Plan (2002 FMEP) which has been agreed to by NOAA for listed steelhead, chum, and Chinook in the ESU.

For ESU-wide hatchery plans, the steelhead production from Cowlitz Trout Hatchery was described in the 1999 Biological Opinion on Artificial Propagation in the Columbia River Basin and the 1999 Review of Artificial Production of Anadromous and Resident Fish in the Columbia River Basin. Current production numbers can vary from past productivity levels and reflect reductions in programs due to ESA concerns.

Hatchery programs in the Columbia system adhere to a number of guidelines, policies and permit requirements in order to operate. These constraints are designed to limit adverse effects on cultured fish, wild fish and the environment that might result from hatchery practices. The following is a list of guidelines, policies and permit requirements that guide WDFW Columbia hatchery operations:

- *WDFW Steelhead Rearing Guidelines.* Details rearing guidelines and rearing parameters statewide (July 31, 2001).
- *Genetic Manual and Guidelines for Pacific Salmon Hatcheries in Washington*.
- *Policies and Procedures for Columbia Basin Anadromous Salmonid Hatcheries* (Genetic Policy Chapter 5, IHOT 1995).
- *Spawning Guidelines for Washington Department of Fisheries Hatcheries*.
- *Policies and Procedures for Columbia Basin Anadromous Salmonid Hatcheries* (Genetic Policy Chapter 7, IHOT 1995).
- *Stock Transfer Guidelines*.
- *Fish Health Policy in the Columbia Basin*.
- *National Pollutant Discharge Elimination System Permit Requirements*

3.2 List all existing cooperative agreements, memoranda of understanding, memoranda of agreement, or other management plans or court orders under which program operates.

- Cowlitz Basin Fish Management Plan - The Department of Fish and Wildlife has developed a framework for a fish management plan for the Cowlitz River basin. This plan is intended to provide management direction for fish protection and restoration in a manner that is consistent with the Endangered Species Act (ESA) and the Wild Salmonid Policy (WSP). The Wild Salmonid Policy was developed by WDFW in response to a mandate from the Washington State Legislature (ESHB 1309) in 1993.
- Mitigation agreement for Cowlitz Hatchery (Agreement Number FERC PROJECT # 2016 dated Aug. 9, 1967). That license expired on December 31, 2001. The Project has operated under annual licenses until the new license was issued (effective July 18, 2003).

The new thirty-five year license was issued March 13, 2003, and became effective on July 18, 2003. Tacoma Power has contracted with the Washington Department of Fish and Wildlife (WDFW) to operate their Cowlitz hatcheries through 2008.

- Cowlitz Fisheries and Hatchery Management Plan (Final August 2004).
- Lewis County Public Utility District's (PUD) Cowlitz Falls project (FERC No. 2833).

3.3 Relationship to harvest objectives.

Summer steelhead are harvested in a variety of sport and commercial fisheries in Washington freshwater fisheries. Steelhead are occasionally harvested in marine fisheries but the number of Cowlitz River fish taken is inconsequential. Fisheries directed at the harvest of Cowlitz River summer steelhead operate in the lower Columbia River and in the Cowlitz River downstream of the Barrier Dam. Sport fisheries occur in the lower Columbia and Cowlitz year round and total adult equivalent exploitation rates have been estimated at 70%. Ocean and freshwater net harvest (Lower Columbia) is non-directed and insignificant. See section 1.12 also.

3.4 Relationship to habitat protection and recovery strategies.

Along with Tacoma City Light, Lewis River PUD, federal and local government agencies, and local citizens including FOC, both technical and policy WDFW personnel participate on a number of habitat protection and recovery strategies in the Cowlitz basin. Key areas of habitat protection and restoration priorities are identified along with strategies to help recover salmonid populations in lower river tributaries or the Upper Cowlitz system. Upper Cowlitz River reintroduction and nutrient enhancement programs have used returns to the Cowlitz Hatcheries as key components in the recovery strategies.

The following processes have been key for habitat protection and evolved as key components to The Lower Columbia Salmon Recovery and Fish and Wildlife Sub-basin Plans (Volume 1; Clark, Cowlitz, Lewis, Skamania and Wahkiakum Counties, December 15, 2004) and along with long term re-licensing agreements with Tacoma City Light:

Sub-Basin Planning
Cowlitz system habitat protection and recovery strategies in the Columbia River and tributaries have been part of Subbasin Planning processes funded by the Northwest Power Planning Council. Recent regional sub-basin planning processes include the Cowlitz River Sub-basin Salmon and Steelhead Production Plan, September 1, 1990. A more recent Draft Cowlitz River Subbasin Summary (May 17, 2002) was prepared for the Northwest Power Planning Council. The Sub-basin efforts provided initial building blocks for the regional recovery plan. *The Lower Columbia fish Recovery Board (LCFRB)* has adopted The Lower Columbia Salmon Recovery and Fish and Wildlife Sub-basin Plans (Volume 1; Clark, Cowlitz, Lewis, Skamania and Wahkiakum Counties, December 15, 2004) with the understanding that Implementation of the schedule and actions for local jurisdictions depends upon funding and other resources.

Habitat Treatment and Protection
Ecosystem Diagnosis and Treatment (EDT) compares habitat today to that of the basin in a historically unmodified state. EDT has been modeled for productivity in the Cowlitz basin in The Lower Columbia Salmon Recovery and Fish and Wildlife Sub-basin Plans and has been used by Tacoma Power for the FERC re-liscensing agreements for the upper basin productivity goals. WDFW is also conducting a Salmon Steelhead Habitat Inventory Assessment Program (SSHIAP), which documents barriers to fish passage. WDFW's habitat program issues hydraulic permits for construction or modifications to streams and wetlands. This provides habitat protection to riparian areas and actual watercourses within the watershed.

Limiting Factors Analysis (LFA)
A WRIA 26 LFA was conducted by the Washington State Conservation Commission (May

2002). WRIA 26 was separated into seven subbasins; Coweeman, Lower Cowlitz, Toutle, Mayfield/Tilton, Riffe Lake, Cispus, and Upper Cowlitz.

Cowlitz River Hydroelectric Project Re-licensing Settlement Agreement (FERC 2016). A number of Articles dealing with habitat issues have been included in the Settlement: The Fish Habitat fund (Article 11) in the amount of $3.0 million before January 18, 2004, the date required by the License. Upon license issuance, Tacoma Power implemented the in-stream flows as prescribed by this article – In-stream flows (Article 13). Ramping Rate Conditions - Tacoma Power has implemented the ramping rates as prescribed by Article 14. The Cowlitz River Fisheries and Hatchery Management Plan (FHMP) Final of August 2004 was Prepared by Tacoma Power to fulfill Article 6 of the Settlement detailing the short range and long range goals of reintroduction and recovery of upper basin indigenous stocks along with hatchery production goals and operations below the barrier dam. The FHMP was built using the concepts and modeling tools inherent in the Ecosystem Diagnosis and Treatment (EDT) methodology and the hatchery production guidelines developed through the Northwest Power Planning Council Artificial Production Review and Evaluation (APRE) process. The APRE process was initiated in response to a Congressional directive to the Northwest Power Planning Council. Building upon the principles and criteria provided by the Hatchery Science Review Group (HSRG) in the *Scientific Framework for Artificial Propagation of Salmon and Steelhead* (HSRG 2002), the APRE identifies hatchery operating procedures that maximize the benefits of artificial production programs while minimizing the risks to natural populations.

Lewis County Public Utility District's (PUD) Cowlitz Falls project (FERC No. 2833)
Although not part of this Project, Lewis County Public Utility District's (PUD) Cowlitz Falls project (FERC No. 2833), constructed in 1994, is the uppermost dam on the mainstem Cowlitz River. It is located just upstream from the headwaters of Riffe Lake and forms the 11-mile-long Lake Scanewa. The mainstem Cowlitz River flows unimpeded above Lake Scannewa (the lake formed by the Cowlitz Falls project) and below Mayfield Dam.

3.5 Ecological interactions.

(1) *Salmonid and non-salmonid fishes or species that could negatively impact the program*: Steelhead smolts can be preyed upon through the entire migration corridor from release to the mainstem Columbia River estuary. Northern pikeminnows and introduced spiny rays along the Columbia mainstem sloughs can prey on chinook smolts as well as avian predators, including gulls, mergansers, cormorants, belted kingfishers, great blue herons and night herons. Based on PIT tags recovered at a large Caspian Tern nesting colony on Rice Island, a dredge material disposal island in the Columbia river estuary, 6-25 million of the estimated 100 million out-migrating juvenile salmonids from the Columbia reaching the estuary were consumed by the terns in 1997 (Roby, et al. 1998). River otters (*Lutra canadensis*) are present in the lower Columbia region and may represent a substantial predation source on juvenile salmonids. Harbor seals (*Phoca vitulina*), Steller sea lions (*Eumetopias jubatus*), and California sea lions (*Zalophus californianus*) are commonly observed in the Columbia River estuary. Seals and sea lions reportedly prey on adult salmonids, although diet studies indicate that other fish species generally comprise the majority of their food. These mammals are often attracted to concentrated fishing effort and can be troublesome to both sport and commercial fishers by taking hooked or net-caught fish before they can be landed. Additionally, other hatchery fish may be a source of competition for Cowlitz steelhead smolts.

(2) Salmonid and non-salmonid fishes or species that could be negatively impacted by the program: Co-occurring natural salmon and steelhead populations in local tributary areas and the Columbia River mainstem corridor areas could be negatively impacted by program fish. Of primary concern are the ESA listed endangered and threatened salmonids: Snake River fall-run chinook salmon ESU (threatened);

Snake River spring/summer-run chinook salmon ESU (threatened); Lower Columbia River chinook salmon ESU (threatened); Upper Columbia River spring-run chinook salmon ESU (endangered); Columbia River chum salmon ESU (threatened); Snake River sockeye salmon ESU (endangered); Upper Columbia River steelhead ESU (endangered); Snake River Basin steelhead ESU (threatened); Lower Columbia River steelhead ESU (threatened); Middle Columbia River steelhead ESU (threatened); and the Columbia River distinct population segment of bull trout (threatened). The potential exists for large-scale hatchery releases of fry and fingerling ocean-type chinook salmon to overwhelm the production capacity of estuaries (Lichatowich and McIntyre 1987). Estuaries may be "overgrazed" when large numbers of ocean-type juveniles enter the estuary en masse (Reimers 1973, Healey 1991). Listed fish can be impacted through a complex web of short and long term processes and over multiple time periods which makes evaluation of this a net effect difficult. WDFW is unaware of studies directly evaluating adverse ecological effects to listed salmon. See also Section 2.2.3 Predation and Competition.

3) Salmonid and non-salmonid fishes or other species that could positively impact the program.
Returning chinook and other salmonid species that naturally spawn in the target stream and surrounding production areas may positively impact program fish. Decaying carcasses may contribute nutrients that increase productivity of the overall system. There are no species that are known to directly positively impact the program. Multiple hatchery programs salmonids releases into the Columbia river system along with listed species (section 2), benefit the program by providing additional predation opportunity in the Columbia mainstem and estuary. Numerous non-salmonid fishes sculpins, lampreys and sucker etc. also would provide the same indirect benefits.

4) Salmonid and non-salmonid fishes or species that could be positively impacted by the program. A host of freshwater and marine species that depend on salmonids as a nutrient and food base may be positively impacted by program fish. The hatchery program may be filling an ecological niche in the freshwater and marine ecosystem. A large number of species are known to utilize juvenile and adult salmon as a nutrient and food base (Groot and Margolis 1991; and McNeil and Himsworth 1980). Wild co-occurring salmonid populations might be benefited as hatchery fish migrate through an area. The migrating hatchery fish may overwhelm predator populations, providing a protective effect to the co-occurring wild populations. Pacific salmon carcasses are also important for nutrient input back to freshwater streams (Cederholm et al. 1999). Successful or non-successfully spawner adults originating from this program may provide a source of nutrients in oligotrohic coastal river systems and stimulate stream productivity. Carcasses from returning adult salmonids have been found to elevate stream productivity through several pathways, including: 1) the releases of nutrients from decaying carcasses has been observed to stimulate primary productivity (Wipfli et al. 1998); 2) the decaying carcasses have been found to enrich the food base of aquatic invertebrates (Mathisen et al. 1988); and 3) juvenile salmonids have been observed to feed directly on the carcasses (Bilby et al. 1996).

Section 4. Water Source

4.1 Provide a quantitative and narrative description of the water source (spring, well, surface), water quality profile and natural limitations to production attributable to the water source.

Wallace Pond is a privately owned gravel pit pond of approximately 20 surface acres. Spring water seeps into Wallace Pond although the amount is unknown. Water seeps through the existing dike road, which separates the pond from the river. Water temperatures reflect ambient temperatures occurring in the river although thermal heating on warm days can elevate the temperatures in the net pens. Water temperatures during the rearing period is generally from the low 40's to the high 50's upon release in April/May.

Toledo Sand and Gravel Pond #5 is ten surface acres. Spring water seeps into Wallace Pond although the amount is unknown. Water seeps through the existing dike road which separates the pond from the river. Water temperatures reflect ambient temperatures occurring in the river although thermal heating on warm days can elevate the temperatures in the net pens. Water temperatures during the rearing period is generally from the low 40's to the high 50's upon release in April/May.

4.2 Indicate risk aversion measures that will be applied to minimize the likelihood for the take of listed natural fish as a result of hatchery water withdrawal, screening, or effluent discharge.

Both Wallace Pond and Toledo Sand and Gravel Ponds are privately owned gravel pit ponds separated from the Cowlitz River. There is no access to the pond by other fish. The facility operates within the limitations established in its National Pollution Discharge Elimination System (NPDES) permit and the production from this facility falls below the minimum production requirement for an NPDES permit.

Section 5. Facilities- Sections 5-9 pertain to the main Cowlitz Trout Hatchery Summer Steelhead program.

5.1 Broodstock collection facilities (or methods).

The majority of the adult brood was trapped at the Cowlitz Salmon Hatchery separator then transported to the Cowlitz Trout Hatchery for broodstock. Broodstock can be collected either at Blue Creek V-trap/weir where adult can volitionally enter a capture pond. The Cowlitz Trout Hatchery has an adult trapping and holding facility that includes a weir and fish ladder in Blue Creek. Adult hold facility consists of three adult ponds @ 10' X 150' X 5'. Fish are hand sorted and handled according to the Cowlitz Complex Adult Fish Handling Protocol. Fish are returned to the river via truck from this facility.

The adult collection facility at the Cowlitz Salmon Hatchery consists of a barrier dam across the Cowlitz River with an associated fish ladder with significant attraction features. The effective length of the barrier weir crest is 318 feet. The fish ladder leads to the sorting, transfer and holding facilities.

The main attraction feature of the Cowlitz Salmon Hatchery fish ladder is located above the barrier dam adjacent to the fish ladder. The fish ladder is equipped with significant attraction features and leads fish to the sorting, transfer and holding facilities. The barrier dam length is 318' and diverts a significant amount of attraction water into the mouth of the fish ladder. This diversion has a bar screen with 7/8 in. clear rack bar spacing. Gravity intake control is achieved by use of a vertical slot weir equipped with a motor operated closure gate. This unit has no screening. An auxiliary vertically-slot entrance is provided at the left bank end of the barrier dam for the purpose of attracting fish from the left bank area to the transport area under the barrier and subsequent movement to the ladder facilities.

5.2 Fish transportation equipment (description of pen, tank, truck, or container used).

Adult fish, and occasionally juveniles, that are to be transported from the Cowlitz Salmon Hatchery fish separation unit are held in one of six 643 cubic feet circular tanks at the adult trap and separator. These tanks are designed to hold up to 1,250 pounds of fish. There are two 1500 gallon tanker trucks capable of hooking to the underside of the circular tanks and receiving fish through displacement of water. This process results in low stress to the adult fish. The trucks are equipped with flumes for planting fish wherever there is adequate access for these trucks along the river or to the Cowlitz Trout Hatchery adult holding ponds.

Juvenile fish being released or transferred between facilities utilize the above trucks and the 1,500 gallon fish tanker assigned to the Cowlitz Trout Hatchery. All vehicles have juvenile and adult handling capability. They all have oxygen and recirculating systems. In addition, several smaller tankers with air stones (one 750 gallon, one 1,000 gallon fiberglass tank and several 250 gallon tanks) are utilized for moving fish around and between the facilities. The 1,500 gallon tanker assigned to the trout hatchery has a hydraulic loading boom for loading adults from the trout hatchery adult ponds.

5.3 Broodstock holding and spawning facilities.

Ponds (No.)	Pond Type	Volume (cu.ft)	Length (ft.)	Width (ft.)	Depth (ft.)	Available Flow (gpm)
1	Concrete Raceway	1472.2	34.0	10.0	4.33	1300

The Cowlitz Trout Hatchery has three adult holding ponds @ 10' X 150' X 5' .

Fish collected at the Cowlitz Salmon Hatchery for broodstock are held in ponds that are 20' X

100' X 5.5'. From the fish ladder separation facility fish can be sorted to two of these ponds. Broodstock can be transferred to a number of other ponds via direct pond to pond transfer or by handling, after anesthesia, in the spawning room and returning to a chosen pond via a return tube. Are they transferred???

At the Cowlitz Trout Hatchery fish are sorted, if mature and needed for spawning, to a holding area in one of the adult ponds. From this holding area the females are killed and placed on a drying rack out of the pond. After the eggs are taken, males are netted up and placed into a small holding container into which carbon dioxide is diffused. Once the males are anesthetized, they are live spawned and then returned to the pond.

5.4 Incubation facilities.

Incubator Type	Units (number)	Flow (gpm)	Volume (cu.ft.)	Loading-Eyeing (eggs/unit)	Loading-Hatching (eggs/unit)
Shallow Trough (2 tier) with incubation baskets	50	3.5-5.0	7.165/trough	20000 (5 baskets per trough)	21000 (1 basket per trough)

The Cowlitz Trout Hatchery has 88 shallow trough incubators. The Cowlitz Salmon Hatchery has 272 stacks of vertical stack (Heath Techna) incubators that are badly in need of replacement. Current re-license proposal by TPU calls for replacing these with 140 new vertical stack incubators

5.5 Rearing facilities.

Wallace Pond and Toledo Sand and Gravel uses a combination of net pens for the rearing portion. Net pens are 20’ x 20’ x 10’ deep. Wallace Pond has three net pens while Toledo Sand and Gravel uses up to four net pens.

5.6 Acclimation/release facilities.

Releases are made from the net pens.

5.7 Describe operational difficulties or disasters that led to significant fish mortality.

The de-nitrification towers deteriorated and caused significant gas bubble disease problems during the 1999-2000 incubation. Outbreaks of *Ceratomyxa shasta* have caused significant fish mortality in the past. Unaccounted for mortality have been attributed to avian predation and bird predation at the raceways was the major cause of the numerous shortages on all of the 2003 stocks. Bird boards were built and installed on all raceway to deter herons from predating off the screens. Electric fencing was reinstalled around the perimeter of all four rearing lakes to deter wading bird predation. Hatchery staff has been bird hazing but not able to keep a continual presence to predation.

5.8 Indicate available back-up systems, and risk aversion measures that will be applied, that minimize the likelihood for the take of listed natural fish that may result from equipment failure, water loss, flooding, disease transmission, or other events that could lead to injury or mortality.

Safeguards to insure an uninterrupted water supply at the Cowlitz Trout Hatchery include auxiliary power to supply two of the four river water intake pumps, the north well and the ozone plant. All water sources and head boxes of all raceways are equipped with low water alarms. The water intake structure also has an alarm for the river water, south well water and the north well water. All wells and river pumps are also alarmed. The river water is a source of numerous pathogens. This water is disinfected by the ozone plant during the warmer rearing months. Since

water is reused between numerous ponds the possibility for the spread of infection is inherent at the facility. Normal fish culture hygiene is practiced. Flooding and muddy water occasionally occurs even though the river level is controlled by three dams.

Section 6. Broodstock Origin and Identity

6.1 Source.

The program utilizes locally adapted non-endemic summer stock derived from adults returning to the Cowlitz Barrier Dam and Blue Creek trap (Cowlitz Trout Hatchery).

6.2.1 History.

Summer steelhead are not native to the Cowlitz River, and broodstock for the summer steelhead was originally from the Skamania Hatchery (a mixture of Washougal and Klickitat River summer steelhead). Historical Washington Department of Game hatchery records show that both winter and summer steelhead fry and smolts were planted into the Cowlitz River between 1936 and 1967, prior to the construction of the Cowlitz Trout Hatchery. Before 1957, steelhead plants were small and comprised of multiple stocks. From 1957 to 1967, less than 50,000 smolts were planted annually (WDG 1986). Between 1964 and 1966, an average of 67,511 juvenile steelhead were collected each year at the Mayfield fish passage facility (Thompson and Rothfus 1969).

6.2.2 Annual size.

Up to 410 adults are collected for the broodstock program. Since 1996, total returns to the Cowlitz include fish collected at both Cowlitz Trout and Cowlitz Salmon Hatcheries range from approximately 1,000 – 6,000 steelhead **(Table 8.).**

Table 8. Total summer steelhead returns to Cowlitz facilities since 1996.

YEAR	Hatchery	Wild
1996	4,491	
1997	5,940	
1998	1,628	
1999	1,196	12
2000	1,373	5
2001	2,153	6
2002	3,716	
2003	3,417	
2004	4,848	

Sources: Cowlitz Hatchery Annual Reports and WDFW Annual Escapement Reports

6.2.3 Past and proposed level of natural fish in the broodstock.

Summer steelhead are not native to the Cowlitz River, and broodstock for the summer steelhead was originally from the Skamania Hatchery (a mixture of Washougal and Klickitat River summer steelhead). Currently, the summer steelhead releases use adults returning to the hatchery and no natural fish have been incorporated in the broodstock. WDFW does not address the Cowlitz River summer steelhead stock in the SaSI report (WDF et. al. 1993); however, for 1980 and 1981, natural fish contributed a mean of 8.7 percent of sampled adults (Tipping 1981 and 1982 as cited in WDW 1990).

6.2.4 Genetic or ecological differences.

Skamania summer steelhead pool with wild summer steelhead from the Lower Columbia River. The difference in spawn timing (3 months earlier for Skamania hatchery fish), poor reproductive success for these fish in the wild (Hulett et al. 1998) and spatial separation at spawning have helped to maintain genetic differences between hatchery and wild fish. Fish are released as age-1+ smolts whereas wild steelhead are predominantly age-2+ smolts. Out-migration timing for both life history types is similar but is slightly earlier for the hatchery component (Fuss et. al. 1998).

6.2.5 Reasons for choosing.

This stock is chosen to provide harvest opportunity with Skamania summer run stock the local summer-run stock currently available for brood stock.

6.3 Indicate risk aversion measures that will be applied to minimize the likelihood for adverse genetic or ecological effects to listed natural fish that may occur as a result of broodstock selection practices.

- Only hatchery stock is used.
- Timing is separated from natural steelhead.
- Holding pond procedures follow IHOT guidelines.
- Other listed fish, if identified, will be released immediately if encountered during the broodstock collection process.

Section 7. Broodstock Collection

7.1 Life-history stage to be collected (adults, eggs, or juveniles).

Adult steelhead arriving at Cowlitz Salmon Hatchery or Cowlitz Trout Hatchery.

7.2 Collection or sampling design

The majority of the adult brood is trapped at the Cowlitz Salmon Hatchery separator then transported to the Cowlitz Trout Hatchery for broodstock. Fish can be collected from July 1 through September 30 at the Cowlitz Trout Hatchery or Cowlitz Salmon Hatchery. Fish are sorted at the Cowlitz Trout Hatchery as infrequently as possible to avoid unnecessary stress. Excess fish in the summer months are marked with an opercule punch and returned to the river for additional sport opportunity. Prior to spawning season all collected fish are sorted by species, sex , new, previously recycled, natural (unmarked) and either returned to river, saved or placed in a resident water depending on policy. There will be no selection for size. All fish will be randomly selected for spawning.

7.3 Identity.

Summer steelhead are identified by run timing and hatchery-origin summer steelhead are adipose-fin clipped. Natural fish are very rare but if found, are returned to the river with most seasons none are found.

7.4 Proposed number to be collected:

7.4.1 Program goal (assuming 1:1 sex ratio for adults):
Up to 410 adults at a female to male 1:1 ratio. Fecundity is approximately 4,200 eggs per female.

7.4.2 Broodstock collection levels for the last twelve years (e.g. 1990-2001), or for most recent years available.

Year	Adults		
	Females	Males	Jacks
1995	350	250	
1996	221	222	
1997	232	127	
1998	256	256	
1999	266	266	
2000	271	261	
2001	296	293	
2002	228	228	
2003	180	180	
2004	219	210	

7.5 Disposition of hatchery-origin fish collected in surplus of broodstock needs.

All adults collected at Cowlitz Trout and Salmon hatcheries are visually sampled, sexed and sorted. Steelhead adults that are above hatchery needs are right operculum punched and returned to stream to enhance the sport fishery.

7.6 Fish transportation and holding methods.

Fish are held in trap (100' x 10') until sorted weekly. Then desired fish are placed into separate sections of a holding raceway. Sections are divided by picket racks. Fish are then sorted weekly to determine ripeness.

Ponds (No.)	Pond Type	Volume (cu.ft)	Length (ft.)	Width (ft.)	Depth (ft.)	Available Flow (gpm)
1	Concrete Raceway	1472.2	34.0	10.0	4.33	1300

Adult fish that are to be transported from the Cowlitz Salmon Hatchery fish separation unit are held in one of six 643 cubic feet circular tanks at the adult trap and separator. These tanks are designed to hold up to 1,250 pounds of fish. There are two 1,500 gallon tanker trucks capable of hooking to the underside of the circular tanks and receiving fish through displacement of water. This process results in low stress to the adult fish. The trucks are equipped with flumes for planting fish wherever there is adequate access for these trucks along the river or to the Cowlitz Trout Hatchery adult holding ponds.

Equipment Type	Capacity (gallons)	Supp. Oxygen (y/n)	Temp. Control (y/n)	Norm. Transit Time (minutes)	Chemical(s) Used	Dosage (ppm)
Tanker Trucks (2)	1500	Y	N	60	Sodium Chloride	0.5
Tanker Truck (Fiberglass Tank)	1000	Y	N	60	Sodium Chloride	0.5

7.7 Describe fish health maintenance and sanitation procedures applied.

Integrated Hatchery Operations Team (IHOT), Pacific Northwest Fish Health Protection committee (PNFHPC), WDFW's Fish Health Manual November 1966, updated March 30, 1998 or Co-manager guidelines are followed. The adult holding area is separated from all other hatchery operations. All equipment and personnel use disinfection including chlorine or iodiphor procedures upon entering or exiting the area. Formalin treatments are administered every other day during the adult summer steelhead-holding period. Total broodstock mortality has ranged from 17.3% - 24.6% in the past three years.

7.8 Disposition of carcasses.

Spawned carcasses of summer-run steelhead are considered inedible. Carcasses are buried. Presently carcasses are not used in nutrient enhancement, primarily for disease (IHNV) concerns.

7.9 Indicate risk aversion measures that will be applied to minimize the likelihood for adverse genetic or ecological effects to listed natural fish resulting from the broodstock collection program.

- Currently, the summer steelhead uses identified marked adults returning to the hatchery.
- Any un-marked fish in holding area is returned to the river in a manner not to harm them.
- The spawn timing of this hatchery stock has been advanced over 3 months since it was first developed in the 1950s. The early spawn timing decreases the potential for mixing between summer steelhead and late winter steelhead on the spawning grounds, and has also decreased successful natural production of the hatchery fish.
- Summer steelhead are released at both hatchery sites to support intensive recreational fisheries in those areas and to have the hatchery summer steelhead home to the facilities.

Section 8. Mating

8.1 Selection method.

Adults are collected from July 1 through September 30. This time frame reduces the chance of mixing summer steelhead with late arriving (June) "late" winter steelhead or early arriving (October) winter steelhead and crew can distinguish stocks by coloration. All selection is random. Individuals spawned are randomly selected from those females ripening after December 1. Females ripening prior to December 1 are rejected for spawning. There will be no selection for size. Spawning will occur from December (50%) through January (50%) and will be completed by January 31 (it has proven difficult to get 50% of the eggs taken during January as most females ripen in December). Spawning began on December 6th and concluded on December 18, 2002, which was represented by three egg takes. Spawning generally occurs weekly.

8.2 Males.

When spawning activities occur, females are lethal spawned while the males are anesthetized with carbon dioxide and live spawned in anticipation of future spawning purposes and/or enhance the sport fishery.

8.3 Fertilization.

Beginning with the 2000 brood spawning (December 1999), all spawning is one male to one female. Sperm is added to eggs from one female and after five minutes, the fertilized eggs are disinfected and water hardened in an iodine solution for one hour. After the one-hour period, the eggs are combined into 5 fish pools and placed in shallow troughs to incubate.

8.4 Cryopreserved gametes.

Cryopreserved gametes are not used.

8.5 Indicate risk aversion measures that will be applied to minimize the likelihood for adverse genetic or ecological effects to listed natural fish resulting from the mating scheme.

Males and females available on a given day are mated randomly. Natural, unmarked fish, will not be used for spawning.

Section 9. Incubation and Rearing.

9.1.1 Number of eggs taken and survival rates to eye-up and/or ponding.

Year	Egg Take	Green-Eyed Survival (%)	Fingerling-Smolt Survival (%)
1991	644,000	NA	NA
1992	720,000	NA	NA
1993	840,000	NA	NA
1994	875,000	NA	NA
1995	942,960	NA	NA
1996	1,027,600	NA	NA
1997	853,800	NA	NA
1998	928,000	92.0	NA
1999	985,833	88.0	NA
2000	1,064,000	88.2	NA
2001	1,113,400	83.4	NA
2002	887,693	NA	NA
2003	798,232	NA	NA
2004	842,006	NA	NA

NA- Data not currently available. Data will be present upon submission to NOAA.

9.1.2 Cause for, and disposition of surplus egg takes.

A surplus of eggs have been held in past years to accomplish two goals: 1) to provide a larger gene pool and 2) to provide insurance against losses due to disease (C. shasta and IHN) and predation. If surplus still occurs over and above program needs, eggs are destroyed. Eggs are combined into 5 fish pools and placed in shallow troughs to incubate.

A fish grader is used for grading and selecting out fish that do not meet program standards. Five families are grouped per incubation unit. Program does not manage family size variation to maintain effective population size. Eggs in excess/surplus to program needs are culled to maintain egg take/juvenile numbers within plus/minus 10% of program goal.

9.1.3 Loading densities applied during incubation.

Eggs from five fish are incubated per basket (in shallow trough) until eyed then 20,000 - 21,000 eggs per trough for hatching. Egg size varies from 3,250 to 3,500 per pound

9.1.4 Incubation conditions.

Flow, temperature and D.O.s are monitored. Oxygen level in troughs normally 8.1 parts per million (ppm).

9.1.5 Ponding.

At 10 days after swim up (volitional), in trough, fish are fed at about 2,000 fish per pound (fpp). Ponding occurs when fish are from 1,500 fpp to 600 fpp depending on pond space. Lengths are not measured. Ponding begins in mid-February continuing into May. The procedures used for determining when fry are based on visual inspection of the amount of yolk remaining

9.1.6 Fish health maintenance and monitoring.

Diseases occurring in fry are: Bacterial Cold Water disease and Trichodina. Standard fish health protocols are followed as defined in the Fish Health Manual (WDFW 1996).

9.1.7 Indicate risk aversion measures that will be applied to minimize the likelihood for adverse genetic and ecological effects to listed fish during incubation.

Families within spawning groups are mixed randomly at ponding so that unintentional rearing differences affect families equally.

9.2.1 Provide survival rate data (*average program performance*) by hatchery life stage (fry to fingerling; fingerling to smolt) for the most recent twelve years (1990-2001), or for years dependable data are available.

See section 9.1.1

9.2.2 Density and loading criteria (goals and actual levels).

Fish are started in concrete troughs with 6.9 cubic feet of water capacity loaded with an average of 20,000 fry. Water flow in troughs is 10 gallons per minute (gpm). Rearing containers are concrete raceways of either 10' X 90’ or 20' X 90' and 5.0 or 2.5 acre rearing ponds. The 10" wide raceways are started with up to 200,000 fish at 1,500 fpp. Twenty-foot wide raceways are started with 400,000 fish maximum at 700 fpp. Water is one-time pass through in the ten-foot wide raceways, but is re-use water in the 20-foot wide raceways. As fish increase in size the numbers are reduced to a final loading number of 35,000 -40,000 fish per 20 foot wide raceway. Ten foot wide raceways are not used at final grow out. Rearing ponds receive fresh and previously used water. Loading is 350,000 fish in the 5.0-acre lakes and 150,000 fish in the 2.5-acre lake.

9.2.3 Fish rearing conditions.

Fish are started in concrete troughs with 6.9 cubic feet of water capacity loaded with an average of 20,000 fry. Water flow in troughs is 10 gallons per minute (gpm). Rearing containers are concrete raceways of either 10' X 90' or 20' X 90' and 5.0 or 2.5 acre rearing ponds. The 10" wide raceways are started with up to 200,000 fish at 1,500 fpp. Twenty-foot wide raceways are started with 400,000 fish maximum at 700 fpp. Water is one-time pass through in the ten foot wide raceways, but is re-use water in the 20 foot wide raceways. As fish increase in size the numbers are reduced to a final loading number of 35,000 -40,000 fish per 20 foot wide raceway. Ten foot wide raceways are not used at final grow out. Rearing ponds receive fresh and previously used water. Loading is 350,000 fish in the 5.0 acre lakes and 150,000 fish in the 2.5 acre lake. Temperature, dissolved oxygen and pH measurements are monitored. Oxygen levels are normally greater than 10 ppm in incoming water. Temperatures range between 40-54 degrees Fahrenheit at both facilities.

9.2.4 Indicate biweekly or monthly fish growth information (average program performance), including length, weight, and condition factor data collected during rearing, if available.

Rearing Period	Length (mm)	Weight (fpp)	Condition Factor	Growth Rate
February at Ponding	NA	2000	NA	NA
March	NA	600	NA	0.700
April	NA	350	NA	0.417
May	NA	200	NA	0.429
June	81.8	85	3.791 E-04	0.575
July	98.6	40	4.175 E-04	0.529
August	117.7	25	4.189 E-04	0.375
September	129.6	18	3.965 E-04	0.280
October	142.8	15	4.019 E-04	0.167
November	150.8	12	4.344 E-04	0.200
December	157.9	10	4.162 E-04	0.167
January	166.3	8.0	4.098 E-04	0.200
February	183.9	7.0	4.113 E-04	0.125
March	191.6	6.0	4.020 E-04	0.143
April	200.3	5.0	4.164 E-04	0.167

9.2.5 Indicate monthly fish growth rate and energy reserve data (*average program performance*), if available.

See section 9.2.4 above.

9.2.6 Indicate food type used, daily application schedule, feeding rate range (e.g. % B.W./day and lbs/gpm inflow), and estimates of total food conversion efficiency during rearing (*average program performance*).

Rearing Period	Food Type	Application Schedule (#feedings/day)	Feeding Rate Range (%B.W./day)	Lbs. Fed Per gpm of Inflow	Food Conversion During Period
Swimup-Fry	Mash/#0	7	3.0-4.0		0.5
Fry	#1 and #2 crumble	7	3.0-4.0		0.7
Fingerling	1.2 mm and 1.5 mm	7	1.5-2.5		0.9
Yearling	2.0 mm	5	1.0-1.5		1.3
Smolt	2.5 mm	57	1.0-1.5		1.5

Fish are fed a dry diet by hand and with response feeders. Conversion will vary from 0.6:1 initial in troughs to 1.2:1 in rearing lakes.

9.2.7 Fish health monitoring, disease treatment, and sanitation procedures.

Fish Health Monitoring	Policy guidance includes: *Fish Health Policy in the Columbia Basin*. Details hatchery practices and operations designed to stop the introduction and/or spread of any diseases within the Columbia Basin. Also, *Policies and Procedures for Columbia Basin Anadromous Salmonid Hatcheries* (Genetic Policy Chapter 5, IHOT 1995). A fish health specialist stationed at Cowlitz Complex inspects fish programs and checks both healthy and if present symptomatic fish. External signs such as lesions, discolorations, and fungal growths will lead to internal examinations of skin, gills and organs. Blood is checked for signs of anemia or other pathogens. Additional tests for virus or parasites are done if warranted.
Disease Treatment	Standard fish health protocols, as defined in the Co-Managers Fish Health Manual (WDFW 1996), are adhered to**.** In the standard ponds, fry and fingerlings have been treated with Florinicol for Bacterial Cold Water disease and Paracide-f for external parasites, fungus and *trichodina* control on holding adults. Infectious Hematopoietic Necrosis Virus (IHNV) can cause either low level chronic mortalities during the rearing period and or significant mortality on smaller subyearling fish before October of the year. Mortality is collected and disposed of at a landfill. Fish health and or treatment reports are kept on file.
Sanitation	All eggs brought to the facility are surface-disinfected with iodophor (as per disease policy). All equipment (nets, tanks, boots, etc.) is disinfected with iodophor between different fish/egg lots. Different fish/egg lots are physically isolated from each other by separate ponds or incubation units. The intent of these activities is to prevent the horizontal spread of pathogens by splashing water. Tank trucks are disinfected between the hauling of adult and juvenile fish. Foot baths containing disinfectant are strategically located on the hatchery grounds to prevent spread of pathogens.

The life cycle of *Ceratomyxa shasta*, the cause of ceratomyxosis, involves an intermediate host, which is a polychaete worm. Wherever this worm exits, *C. shasta* may become established by the introduction of infected fish or infective water into the area. The lower Cowlitz River appears to harbor C.shasta. Wild and hatchery fish may contract this disease as they migrate through the lower river.

9.2.8 Smolt development indices (e.g. gill ATPase activity), if applicable.

The migratory state of the release population is determined by behavior, physical appearance, and other criteria.

9.2.9 Indicate the use of "natural" rearing methods as applied in the program.

The project biologist has studied rearing fish in "natural" lakes with submerged structures. Results pending return of adults.

9.2.10 Indicate risk aversion measures that will be applied to minimize the likelihood for adverse genetic and ecological effects to listed fish under propagation.

When juveniles are culled, it is not done randomly over all segments of the population.

Section 10. Release

10.1 Proposed fish release levels.

FBD plans for up to 100,000 released smolts annually.

10.2 Specific location(s) of proposed release(s).

Wallace Pond net pens are located adjacent to the Cowlitz River at approximately RKm 41.1. Fish are released from net pens located in Wallace Ponds directly to the river. Toledo Sand and Gravel Net Pens are located adjacent to the Cowlitz River at RKm 44.5 shortly upstream of the town of Toledo.

10.3 Actual numbers and sizes of fish released by age class through the program.

	Yearling Release				
Release Year	Wallace Net Pens	Toledo Sand and Gravel	Lou Reebs Pens*	Date (MM/DD)	Avg Size (fpp)
1997		24,995		4/29	5.6-8.4
1998		44,002	4,958	5/2	6.0
1999		39,498	9,978	5/1	7.3
2000			10,000	4/17-5/11	4.6-9.4
2001			5,376	5/8	6.5
2002			10,673	4/10-5/3	4.2 – 5.6
2003	32,924			4/30	9.5
2004	63,433			4/15	5.1

*Releases made from Lou Reebs, changed to Wallace Ponds.

10.4 Actual dates of releases and description of release protocols.

Wallace Pond: See dates of release above in section 10.3. Fish have been reared in net pens anchored in Wallace Pond from March to April/May. For release, the net pens are towed approximately 100 meters to the northwest section of Wallace Pond. This is where a dike road separates Wallace Pond from the Cowlitz River and is at it's narrowest. A six inch diameter PVC pipe is embedded through the dike and extends out approximately 7' over an off channel section adjacent to the river. Fish need to be pumped from the pens through the pipe extending approximately 150' to where the end of the pipe spills to the river. This is a forced release when fish reach program size in early March.

Toledo Sand and Gravel: Fish have been reared in net pens anchored in Pond #5 from March to April/May. For release, the net pens are towed approximately 200 meters to the south section of the Pond. A 100' foot open channel leads to the river and fish are crowded from the net pens to this channel.

10.5 Fish transportation procedures, if applicable.

Equipment Type	Capacity (gallons)	Supp. Oxygen (y/n)	Temp. Control (y/n)	Norm. Transit Time (minutes)	Chemical(s) Used	Dosage (ppm)
Tanker Truck (2)	1500	Y	N	30-60	NA	NA
Tanker Truck (1)	750	Y	N	30-60	NA	NA
Tanker Truck (1)	1000	Y	N	30-60	NA	NA

Fish are transferred from Cowlitz Trout Hatchery to Wallace and Toledo Sand and Gravel Ponds in the tankers above.

10.6 Acclimation procedures (*methods applied and length of time*).

Fish are reared in the Wallace and Toledo Sand and Gravel Ponds Net Pens for approximately 30-45 days prior to release. Both gravel ponds get seepage through the existing dikes from the Cowlitz River. Water can seep through the dike road directly from the Cowlitz River and regulates the level of the pond with some spring seepage feeding the pond also reported. Both spring Chinook and summer steelhead releases imprint to these lower release sites as fishing guides congregate to these areas heavily (pers. comm. Don Glaser).

10.8 Disposition plans for fish identified at the time of release as surplus to programmed or approved levels

Only a set program number as identified in the FBD are transferred to the FOC sites. In some years, shortages of fish can occur at the hatchery and fish are not available for one or both of the programs.

10.9 Fish health certification procedures applied pre-release.

Prior to release, population health and condition is established by the Cowlitz Complex Fish Health Specialist. This is commonly done 1-3 weeks pre-release. The fish specialist examines affected fish, and recommends the appropriate treatment. Reporting and control of selected fish pathogens are done in accordance with the Co-managers Fish Disease Control Policy and IHOT guidelines.

10.10 Emergency release procedures in response to flooding or water system failure.

The net pens would elevate within the gravel ponds due to flooding. Net pen material allows water exchange even in flooding conditions.

10.11 Indicate risk aversion measures that will be applied to minimize the likelihood for adverse genetic and ecological effects to listed fish resulting from fish releases.

- Releases are consistent with past history indicating the time, size and conditional release of smolts for migration fitness and smoltification occurs within nearly the entire population, which reduces residence time in the river after release.
- Current size of release experiments in the lower river will be used to improve survival and result in additional information needed for life history traits
- Physiological measures, including allowable population fork length standard deviation (STD) and coefficient of variation (CV) maximums, will be used to monitor growth and population variations
- Fish are acclimated for several weeks at the site before release.
- Fish not reaching smolt guideline size are not released. Fish are planted in Riffe Lake if it is determined that they would not reach size by release in the spring.

Current levels of hatchery production in the Cowlitz River Basin are undergoing ESA consultations between NOAA Fisheries and the WDFW. Artificial propagation activities in this license that will be proposed as part of the FHMP, the Remodeling and Phase-In Plan, and the Disease Management Plan,19 will undergo a separate ESA consultation as these plans are not developed enough to give a clear understanding of the proposed action on which to consult. Any future hatchery consultation will be in the overall context or to meet the goal of reestablishing self-sustaining population levels consistent with a viable ESU scenario. In other words, viable populations of spring chinook salmon and a contributing population of steelhead will need to be established above the Project. When the plan is updated, NOAA Fisheries will be consulted to determine if re-initiation of the consultation is warranted, pursuant to which NOAA Fisheries will consider the potential for both beneficial and adverse effects to listed species. This section generally considers the direct and indirect effects to listed species that may result from hatchery mitigation actions.

Section 11. Monitoring and Evaluation of Performance Indicators

11.1.1 Describe plans and methods proposed to collect data necessary to respond to each "Performance Indicator" identified for the program.

In addition to the regional monitoring activities associated with this program, see section 2.2.3-Monitoring, the Cowlitz Hatchery evaluation Biologist monitors and evaluates the following factors associated with this hatchery program: Condition Factor of hatchery spring chinook smolts prior to release, Smolt-to-Adult survival rates of hatchery spring chinook releases, Freshwater harvest levels for hatchery program releases. In association with upper Cowlitz watershed recovery efforts, the Cowlitz Hatchery evaluation Biologist also operates the smolt trap at Mayfield Dam. This trap receives emigrating juveniles generated from plants and natural production in the Tilton River watershed.

As part of Tacoma Powers mitigation for the Cowlitz River dams, WDFW is funded to conduct monitoring and evaluation of the fisheries resources in the lower Cowlitz River. These include spawning and population monitoring of wild steelhead and fall chinook, angler surveys, biological sampling of the hatchery escapement and hatchery practice studies. This work is reported in the Cowlitz Fish Biologist Annual Reports (WDFW, Olympia). Populations of wild fall chinook are monitored by aerial redd counts and biological sampling of carcasses for age, mark and other population data. The aerial surveys have been conducted annually since the 1970s. Seining and CWT tagging of fall Chinook juveniles to estimate survival has also begun on the lower river.

The completion of the Surface Collection System and Fish Facilities at the Cowlitz Falls Dam in 1996 marked the beginning of a unique opportunity to restore anadromous salmonids to an estimated 240 linear miles of historically productive habitat in the upper Cowlitz and Cispus watersheds. Since then, WDFW funded by Tacoma Power, has monitored productivity of spring Chinook, late winter steelhead, coho and cutthroat trout. Fish Collection Efficiency (FCE) is monitored by mark-recapture of steelhead, coho and age-zero spring chinook smolts that are marked with visible implant elastomer tags.

The Cowlitz River Fisheries and Hatchery Management Plan is a component of the Cowlitz Hydroelectric Project Settlement Agreement with a lrge component of monitoring and evaluationfo the upper basin recovery. Currently monitoring is being conducted as a component of the Cowlitz Evaluation Program funded by Tacoma Power. Current funded activities include: hatchery broodstock sampling for biological and mark information; Lower Columbia River fall chinook spawning ground surveys for naturally spawning fall chinook, including aerial redd counts and biological and mark examination of carcasses; tributary steelhead spawning ground surveys for abundance; operation of Mayfield Dam juvenile collector to enumerate juvenile out-migration; creel survey of lower Cowlitz and reservoir fisheries; warm water fish population composition and abundance surveys on Mayfield Lake and Swofford Pond, reintroduction of coho, steelhead, and cutthroat into the Tilton River and hatchery production evaluations. These activities focus on the Lower River and Tilton. This plan and future decisions will be guided by a Fisheries Technical Team. Fisheries obligations will be met through a combination of effective upstream and downstream passage, habitat restoration and improvement, and an adaptive management program.

11.1.2 Indicate whether funding, staffing, and other support logistics are available or committed to allow implementation of the monitoring and evaluation program.

Tacoma Public Utilities funds the staffing and support logistics for the program monitoring and evaluation. Staffing is comprised of and derived from a pool of personnel used in fish cultural and pathology related tasks.

11.2 Indicate risk aversion measures that will be applied to minimize the likelihood for adverse genetic and ecological effects to listed fish resulting from monitoring and evaluation activities.

Monitoring activities follow scientific protocol in handling listed fish. Smolts handled for data collection such as condition factor, length and weight are anesthetized with MS – 222 and placed in recovery tanks before hauling. At the salmon hatchery separation facility, adults can be transferred via water to water in the tanker truck fish to minimize stress.

Section 12. Research

12.1 Objective or purpose.

See Cowlitz Summer Steelhead HGMP.

12.2 Cooperating and funding agencies.

12.3 Principle investigator or project supervisor and staff.

12.4 Status of stock, particularly the group affected by project, if different than the stock(s) described in Section 2.

12.5 Techniques: include capture methods, drugs, samples collected, tags applied.

12.6 Dates or time periods in which research activity occurs.

12.7 Care and maintenance of live fish or eggs, holding duration, transport methods.

12.8 Expected type and effects of take and potential for injury or mortality.

12.9 Level of take of listed fish: number of range or fish handled, injured, or killed by sex, age, or size, if not already indicated in Section 2 and the attached "take table" (Table 1).

12.10 Alternative methods to achieve project objects.

12.11 List species similar or related to the threatened species; provide number and causes of mortality related to this research project.

12.12 Indicate risk aversion measures that will be applied to minimize the likelihood for adverse ecological effects, injury or mortality to listed fish as a result of the proposed research activities.

Section 13. Attachments and Citations

13.1 Attachments and Citations

Becker, C.D. 1973. Food and growth parameters of juvenile Chinook salmon, *Oncorhynchus tshawytscha*, in central Columbia River. Fish. Bull. 71: 387-400.

Bilby, R.E., B.R. Fransen, and P.A. Bisson. 1996. Incorporation of nitrogen and carbon from spawning coho salmon into the trophic system of small streams: evidence from stable isotopes. Can. J. Fish. Aquat. Scit. 53: 164-173.

Cederholm, C.J. et al. 1999. Pacific salmon carcasses: Essential contributions of nutrients and energy for aquatic and terrestrial ecosystems. Fisheries 24 (10): 6-15.

Dawley, E. M., R.D. Ledgerwood, T.H Blahm, R.A. Kirn, and A.E. Rankis. 1984. Migrational Characteristics And Survival Of Juvenile Salmonids entering the Columbia River estuary During 1983. Annual Report to the Bonneville Power Administration, Portland, OR.

Easterbrooks, J. 1980. Salmon production potential evaluation for the Cowlitz River system upstream of the Cowlitz Falls Dam site. Washington Department of Fisheries.

Fuss, H.J., J. Byrne, and C. Ashbrook. 1998. Migratory Behavior and Incidence of Post-Release Residualism of Hatchery Reared Coho and Chinook Salmon Released into the Elochoman River, WDFW Annual Report FPA99-08.

Harza. The 1997 and 1998 technical study reports, Cowlitz River Hydroelectric Project. Vol. 2, 35-42.

Harza 2000. Lower Clark Fork River Fish Transport Plan. Final Report to Avista Corp. Portland, Oregon, 32 pgs.

Hawkins, S.W., Tipping, J. M. 1999. Predation By Juvenile Hatchery Salmonids on Wild Fall Chinook Salmon Fry in the Lewis River, Washington. California Fish and Game 85(3):124-129

Healey, M. C. 1991. Life history of chinook salmon. Pages 311–394 in C. Groot and L. Margolis (eds.), Pacific salmon life histories. Vancouver, BC: University of British Columbia Press. Groot and Margolis 1991

IHOT (Integrated Hatchery Operations Team). 1995. Operation plans for anadromous fish Production facilities in the Columbia River basin. Volume III - Washington. Annual Report 1995. Bonneville Power Administration, Portland, OR. Project Number 92-043. 536 pp.

Lichatowich, J. A., and J. D. McIntyre. 1987. Use of hatcheries in the management of Pacific anadromous salmonids. American Fisheries Society Symposium 1: 131-136.

Mathisen, O.A., P.L. Parker, J.J. Goering, T.C. Kline, P.H. Poe, and R.S. Scalan. 1988. Recycling of marine elements transported into freshwater systems by anadromous salmon. Verh. Int. Ver. Limnol. 23: 2249-2258.

McElhany, P., T.Bachman, C. Busack, S. Heppell, S. Kolmes, A. Maule, J. Myers, D. Rawding, D. Shively, A. Steel, C. Steward, and T. Whitesel. 2003. Interim report on viability criteria for Willamette and Lower Columbia Basin Pacific salmonids. Unpublished report. NOAA Fisheries.

McNeil, W.J. and D.C. Himsworth. 1980. Salmonid ecosystems of the North Pacific. Oregon State University Press and Oregon State University Sea Grant College Program, Corvallis, Oregon.

Mobrand Biometrics, Inc. August, 1999 Draft. The EDT Method. 9920 SW Bank Rd, Vashon, WA 98070. (206) 463 5003.

Muir, W.O. and R.L. Emmelt. 1988. Food habits of migrating salmonid smolts passing Bonneville Dam in the Columbia River, 1984. Regulated River 2: 1-10.

Myers, J.M., C. Busack, D. Rawding, and A. Marshall. 2002. Identifying historical populations of chinook and chum salmon and steelhead within the Lower Columbia River and Upper Willamette River Evolutionarily Significant Units. May 10, 2002 Co-manager Review Draft. Willamette/Lower Columbia River Technical Recovery Team.

Pearsons, T.N., G.A. McMichael, K.D. Ham, E.L. Bartrand, A. l. Fritts, and C. W. Hopley. 1998. Yakima River species interactions studies. Progress report 1995-1997 submitted to Bonneville Power Administration, Portland, Oregon. DOE/BP-64878-6

Reimers, P .E. 1973. The length of residence of juvenile fall chinook salmon in the Sixes River, Oregon. Fish. Comrn. Ore. Res. Briefs. 4:1-43.

Roby, D.D., D.P. Craig, K. Collis, and S.L. Adamany. 1998. Avian Predation on Juvenile Salmonids in the Lower Columbia River 1997 Annual Report. Bonneville Power Administration Contract 97BI33475 and U.S. Army Corps of Engineers Contract E96970049. 70 p.

Sager, P.M., and G.J. Glova. 1988. Diet feeding periodictiy, daily ration and prey selection of a riverine population of juvenile Chinook salmon, *Oncorhynchus tshawytscha*. J. Fish Biol. 33: 643-653.

SIWG (Species Interaction Work Group). 1984. Evaluation of potential interaction effects in the planning and selection of salmonid enhancement projects. J. Rensel, chairman and K. Fresh editor. Report prepared for the Enhancement Planning Team for implementation of the Salmon and Steelhead Conservation and Enhancement Act of 1980. Washington Dept. of Fish and Wildlife. Olympia, WA. 80 pp.

Thompson, J. and L. Rothfus. 1969. Biological observations of salmonids passing Mayfield Dam. Washington Department of Fisheries.

USFWS (U.S. Fish and Wildlife Service). 1994. Biological assessment for operation of U.S. Fish and Wildlife Service operated or funded hatcheries in the Columbia River Basin in 1995-1998. Submitted to National Marine Fisheries Service (NMFS) under cover letter, dated August 2, 1994, from William F. Shake, Acting USFWS Regional Director, to Brian Brown, NMFS.
Washington Department of Fisheries (WDF). 1951. Planning Reports. Lower Columbia River Fisheries Development Program. Preliminary draft, August 1951. 211 p. + appendices
Washington Department of Fisheries. 1951. Lower Columbia River fisheries development program. Cowlitz area, Washington. Washington Department of Fisheries and U.S. Fish and Wildlife Service. August.

Washington Department of Fisheries (WDF), Washington Department of Wildlife (WDW), and Western Washington Treaty Indian Tribes (WWTIT). 1992. 1992 Washington State salmon and steelhead stock inventory (SASSI). Washington Dept. Fish and Wildlife, 600 Capitol Way N, Olympia, WA. 98501-1091. 212 pp.

Washington Department of Fisheries (WDF) and Washington Department of Wildlife (WDW). 1993. 1992 Washington State salmon and steelhead stock inventory - Appendix three Columbia River stocks. Washington Dept. Fish and Wildlife, 600 Capitol Way N, Olympia, WA. 98501-1091. 580 pp.

WDW (Washington Department of Wildlife), Confederated Tribes and Bands of the Yakima Indian Nation, Confederated Tribes of the Colville Indian Reservation, and Washington Department of Fisheries. 1990. Methow and Okanogan rivers Subbasin, salmon and steelhead production plan. Available from the Northwest Power Planning Council, Portland, OR. WDW 1990

Wipfli, M.S., J. Hudson, and J. Caouette. 1998 Influence of salmon carcasses on stream productivity: response of biofilm and benthic macroinvertebrates in southeastern Alaska, U.S.A. Can J. Fish. Aquat. Sci. 55: 1503-1511.

Section 14. CERTIFICATION LANGUAGE AND SIGNATURE OF RESPONSIBLE PARTY

14.1 Certification Language and Signature of Responsible Party

"I hereby certify that the information provided is complete, true and correct to the best of my knowledge and belief. I understand that the information provided in this HGMP is submitted for the purpose of receiving limits from take prohibitions specified under the Endangered Species Act of 1973 (16 U.S.C.1531-1543) and regulations promulgated thereafter for the proposed hatchery program, and that any false statement may subject me to the criminal penalties of 18 U.S.C. 1001, or penalties provided under the Endangered Species Act of 1973."

Name, Title, and Signature of Applicant:

Certified by_____ Date:_____